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MERCURY MANNED ORBITAL CAPSULE

DETAIL SPECIFICATION (U)

(Title Unclassified)

(NASA CR-55574,

(~~REPORT~~ 6603) SERIAL NO. 115

N-91759

McDONNELL Aircraft Corporation, St. Louis, Mo.

5605308

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[6]

SUBMITTED UNDER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA CONTRACT NAS 5-59)

PREPARED BY L. M. PARKER APPROVED BY E. M. FLESH

APPROVED BY _____ APPROVED BY ALBERT UTSCH

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(3)

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1.0 SCOPE AND CLASSIFICATION

2.1.2.2 1.1 SCOPE - This specification shall define the details of design, construction, equipment, testing and data requirements for a Manned Satellite Capsule as follows:

NASA Designation..... Project Mercury R-1
Designer's Name..... McDonnell Aircraft Corporation (MAC)
Model Designation..... Model 133K
Number and Places for Crew.... One Cabin Enclosure
Booster Vehicle..... Atlas D Missile (HS-36)

1.1.1 MISSIONS

2.1.1 1.1.1.1 GENERAL - The mission to be described shall be capable of accomplishment with a human occupant. Missions other than manned orbital missions shall be as specified in configuration specifications for individual capsules. These configuration documents bear the same report R-1
number as this basic specification with an identifying dash number corresponding to the capsule number.

2.1.2 1.1.1.2 PRIMARY MISSION - The primary mission shall be the launching of a manned capsule into semipermanent orbit and subsequent safe recovery to the surface of the earth at a designated time and/or position through use of retrograde thrust and aerodynamic drag. The atmospheric forces used in trajectory and other calculations shall be based on atmospheric density and temperature variations of ARDC 1959 Model atmosphere as defined in Paragraph 3.2.7 herein. R-1

2.1.2.1 1.1.1.2.1 Launching site of the manned orbital capsules shall be Cape Canaveral, Florida. Launching will be possible at any azimuth within thirty (30) degrees of due east.

2.1.2.2 1.1.1.2.2 The design of the capsule shall be based on the use of a single Atlas D missile as the launching booster. The capsule shall replace the missile nose cone in a manner which requires a minimum of modifications to the booster system.

2.1.2.4 1.1.1.2.3 The launch booster system will be capable of projecting the capsule into an orbit described and limited as follows:

2.1.2.4.1 1.1.1.2.3.1 The projection altitude will be one hundred and five (105) nautical miles, plus or minus two (2) nautical miles.

2.1.2.4.2 1.1.1.2.3.2 The perigee altitude will not be less than one hundred and three (103) nautical miles.

1.1.1.2.3.3 The apogee altitude will not be greater than one-hundred and fifteen (115) nautical miles.

2.1.2.4.3 1.1.1.2.3.4 The eccentricity will not be greater than five-thousandths (0.005).

2.1.2.5 1.1.1.2.4 The number of orbital cycles per mission shall be two (2) or three (3).

2.1.2.6 1.1.1.2.5 The following specifications pertain to the recovery of the capsule from orbit:

2.1.2.6.1 1.1.1.2.5.1 The nominal position of the point at which re-entry is initiated shall be such that impact occurs in a prescribed area in the Atlantic Ocean; however, in the event of an emergency, it shall be possible for the human occupant to initiate the re-entry at any point in the orbit.

2.1.2.6.2 1.1.1.2.5.2 The re-entry shall be accomplished by application of retrograde thrust to produce a perigee altitude within the atmosphere. The magnitude and direction of retrograde thrust will be specified so that angles of re-entry into the atmosphere at an altitude 400,000 feet (approximately sixty-four (64) nautical miles) will be between .923 and 2.44 degrees. R-1

2.1.2.6.3 1.1.1.2.5.3 A drogue chute shall be deployed at 40,000 feet geometric pressure altitude to provide improved dynamic stability of the capsule. R-1

2.1.2.6.4 1.1.1.2.5.4 A landing parachute shall be deployed at an altitude sufficiently great to allow time to deploy a second parachute in event of failure of the first and to reduce sinking speed at impact to less than thirty (30) feet per second. Impact shall be considered to take place at an altitude of five thousand (5000) feet. Commensurate with the above requirements, deployment altitudes shall be low enough to keep drift from winds aloft from seriously affecting the area of impact.

2.1.2.6.5 1.1.1.2.5.5 The capsule in the landing condition shall be designed for water landing and shall be bouyant and stable upright in the water. Protection from injury to the human occupant shall be afforded under conditions of land impact.

2.1.2.6.6 1.1.1.2.5.6 The capsule and the systems within the capsule necessary for location, recovery, and survival shall be capable of sustained operation for a period of twelve (12) hours after impact with the surface of the earth. This requirement shall be in addition to the four and one-half (4-1/2) hours requirements associated with the space flight phase of the operation.

2.1.3 1.1.1.3 CHECKOUT MISSIONS - In order to expeditiously lead up to successful achievement of the primary mission, the requirements of the following checkout missions shall be considered in the capsule design. R-1

2.1.3.1 1.1.1.3.1 BALLISTIC TRAJECTORIES OF LIMITED VELOCITY AND RANGE FOR RE-ENTRY AND RECOVERY SIMULATION - The re-entry and recovery phases of these missions shall be accomplished in the same manner as specified for the primary mission. The peak decelerations achieved during re-entry shall equal those applicable to the primary mission. As this type of checkout mission may represent the first flight tests of a manned space capsule, a buildup in velocity and range may be required. Missions other than manned orbital missions shall be as specified in configuration specifications for individual capsules. These configuration documents bear the same report number as this basic specification with an identifying dash number corresponding to the capsule number.

2.1.4 1.1.1.4 ABORTED MISSIONS - During various periods of the launch operation, it may be necessary to abort the mission and escape from the vicinity of the rocket booster system. An active escape system shall be an integral part of the capsule until twenty (20) seconds after booster staging. At times greater than booster staging plus twenty (20) seconds, escape shall be accomplished by shutting down the Atlas sustainer engine and firing posigrade rockets which shall be a part of the capsule to aid in separation of the booster and capsule. R-1

2.1.4.1 1.1.1.4.1 The following requirements shall apply to the escape system:

2.1.4.1.1 1.1.1.4.1.1 The occupant shall remain within the capsule, and escape shall be accomplished by the firing of an escape rocket using solid propellants. In event of an abort, provisions shall be made for thrust cut-off of the booster rocket.

2.1.4.1.3 1.1.1.4.1.2 In an escape from the ground launching pad, the altitude achieved shall be greater than twenty-two hundred (2200) feet.

2.1.4.1.5 Partial 1.1.1.4.1.3 During the escape when the dynamic pressure is reduced to a satisfactory low value, the capsule configuration shall be altered in a manner to provide an aerodynamically stable trim condition in the normal re-entry attitude.

2.1.4.1.6 1.1.1.4.1.4 When the escape maneuver takes place after tower separation, the capsule shall be aligned in the re-entry attitude by means of the automatic stabilization and control system specified in Paragraph 3.10 herein.

3.1 2.0 APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS - McDonnell Aircraft Corporation's prime objective relative to Government specifications shall be compliance with applicable documents to the most practicable extent, with the object of providing an optimum operational vehicle within the specified time schedule. In event of a discrepancy between this specification and any document referenced herein this specification shall take precedence:

2.1 REFERENCES - This detail specification as approved shall amplify or take precedence as applicable over the following references, which shall be incorporated herein.

Sections 2.1 through 2.6 inclusively of National Aeronautics and Space Administration Specification S-6, dated 14 November 1958, revised 26 January 1959.

McDonnell Aircraft Corporation Report No. 6483, "NASA Manned Satellite Capsule, Part II Technical Proposal," dated 4 December 1958.

3.1 2.1.1 The following publications, standards, specifications and drawings with dates as listed below form a part of this specification to the extent specified herein.

2.1.2 PUBLICATIONS -

McDonnell Aircraft Corporation Report No. 6495, "Project Mercury Specification Applicability Criteria," dated 4 December 1958, revised 1 July 1959.

McDonnell Aircraft Corporation Report No. 6693, "Project Mercury Capsule Structural Design Criteria," dated 6 April 1959, revised 3 August 1960.

3.1 2.1.3 STANDARDS -

ANA Bulletin 143d	Specifications and Standards, Use of, dated 19 August 1954
ANA Bulletin 147r	Specifications and Standards of Non-Government Organizations dated 1 June 1958
MIL-STD-129B	Marking for Shipment and Storage, dated 10 April 1957
MIL-STD-130	Identification of U.S. Military Property, dated 4 March 1953 (Reference Guide Only)
MIL-STD-210A	Climatic Extremes for Military Equipment, dated 2 August 1957

3.1

2.1.4 SPECIFICATIONS - Specifications applicable to specific subsystems shall be delineated in McDonnell prepared specification control drawings. Specifications which shall be used as reference guides only shall be defined in the applicable paragraph herein. Specifications which shall be generally applicable to the Mercury capsule are listed below for information. Specifications applicable to subsystems or components purchased from vendors or subsystem manufacturers to documents other than specification control drawings are also listed below, and in MAC Report No. 6495, revised 1 July 1959.

MIL-E-5272A-1	Environmental Testing, Aeronautical and Associated Equipment, General Specification for, dated 15 July 1955
MIL-E-5400B(ASG)	Electronic Equipment, Aircraft, General Specification for, dated 24 May 1957
MIL-I-6181B	Interference Control Requirements, Aeronautical Equipment
MIL-S-7742-1	Screw Threads, Standard Aeronautical, dated 28 May 1956

2.2 CHANGES - Changes to the detail specification shall be classified as follows:

TYPE I - Type I changes shall be only those changes which affect the scope of the contract and thereby have a corresponding effect on cost and/or delivery. These changes will be subject to negotiation through the contract change procedure (CCP). Upon approval of the CCP, the detail specification will be changed accordingly and revisions transmitted to NASA.

TYPE II - Type II changes shall be those changes considered necessary to provide an optimum product within the established program but which do not affect the scope of the contract. Those type II changes of a nature requiring concurrence by the NASA shall be submitted to the Contracting Officer's Resident Representative for signature prior to transmittal to NASA. Other type II changes, considered by the contractor to be of a minor nature shall be forwarded directly to NASA.

2.2.1 REQUEST FOR ALTERATION - The following requests for alteration, recommended during the Project Mercury Mock-up Inspection on 17 and 18 March 1959, have been incorporated:

2.2.1 REQUEST FOR ALTERATION - (Continued)

RFA No.	SUBJECT
1	Humidity Indicator Addition
5	Improved Pilot Exit Arrangement (Addition of Inflatable Bags to Recovery Compartment)
7	Waste Storage Provisions
11	Control System Protection
12	Abort Handle Unlock Button and Flange Addition
16*	Instrument Panel Change
17	Telelight Warning and Sequence Panel Guarded Push Buttons
20	Attitude Indicator Change and "Mike" Button Addition
22*	Left-Hand Console Change
23	Reinforced Areas for Pilot Egress
25	Lateral and Normal Accelerometer Removal
26	Right Arm Support Improvement
27	Pilot Restraint Improvement
29	Pilot Observer Camera Installation

* Weight Changes Only

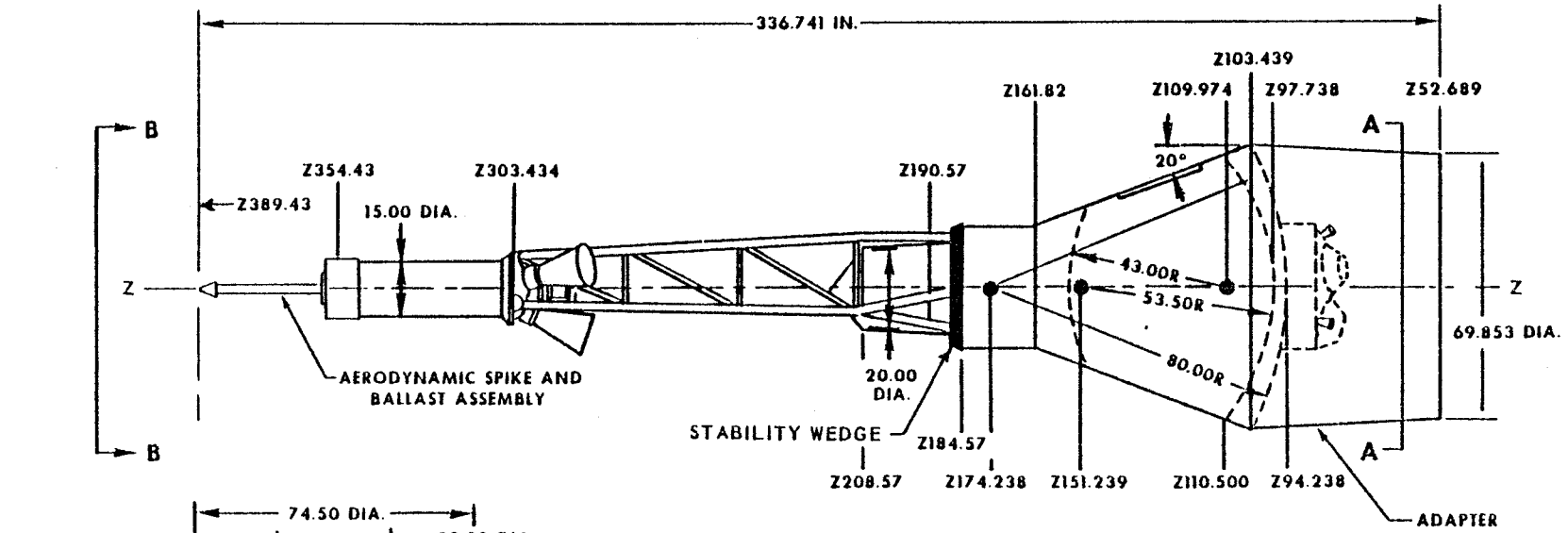
2.2.2 CONTRACT CHANGE PROPOSALS - The design changes resultant from the following Contract Change Proposals (CCP's) are reflected in this detail specification:

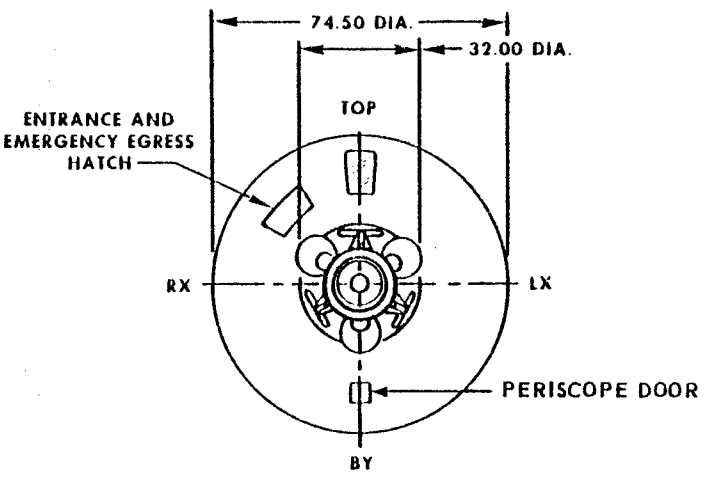
CCP	TITLE
3	Posigrade Rocket Installation
6	Manual Emergency Controls for Escape (Separation) Rocket Jettison, Antenna Assembly, Emergency Parachute
13	Additional Capability of PAM Telemetry in Capsule Instrumentation Circuitry
19	250 V.A. Standby Inverter
40	H_2O_2 Toroidal Tanks; Reaction Control System
41	Reefed Ring-Sail Landing Parachutes, Installation of
42	Orbit Light; Specification Requirement Deletion
43	Instrumentation Changes; Subcarrier Oscillator and Commutator Replacements
44	Impact Pressure Measurement; Deletion of Requirement
45	Addition of 2 Watt UHF Orbital Transmitter
48	Low Power Telemetry; Power Output Increase
51	Two Additional Manned Satellite Capsules
57	Six Additional Manned Satellite Capsules
58-1	Astronaut Emergency Egress Hatch Installation
54	Publications Outside the Scope of Mercury Contract NAS5-59
54-1	GSE Publications

2.2.2 CONTRACT CHANGE PROPOSALS - (Continued)

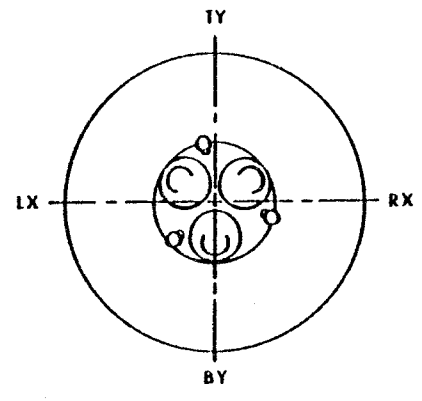
CCP	TITLE
61-2	Redundant Rate Stabilization Control System
66	Communications Systems; Frequency Changes
73	Astronaut Observation Window Installation
74	Rescue Aids Switch Bypass Relay and Bypass Switch for 30 Second Retro Firing Delay
76	Main Instrument Panel Redesign
78	Mercury/Atlas Adapter Redesign
82	Capsule Dye Marker Change
84	Telemetering of Posigrade Rocket Firing
85	Radar Chaff Redesign and Reinstallation
90-1	Production Installation of Inflatable Landing Impact Bags
91	Elimination of Minitrack/Microlock Beacon
92-1	Production Installation; 3 Orbit Battery
93	SOFAR Bomb Installation
97	Metallic Coating on Drogue Parachute; Deletion of
98	Smoke Recovery Aid; Removal of
101	Post Landing Operational Sequence Change for Capsule Instrumentation
106	Patch Cable - Command Receiver Code Assembly, Provision of
109	Astronaut Operated Switch for Time Zero Relay; Addition of
113	Escape Tower Ballast Reduction
117	Retrograde Rocket Firing Information; Provision of
118	Submittal of 3 Blueprint Copies to NASA in Lieu of VanDykes
130	UHF Rescue Beacon (Super Sarah) and Antenna; Additional Provision of
131	Satellite Clock; Removal of Event No. 1
156	Retrograde and Posigrade Information Report for World Wide Range Stations
160	Transducer Replacement
164	Double Pulse Coding for C&S Band Beacons
165	HF Whip Antenna
166	Astronaut Couch/Mold Modifications
168	Transmittal of 6 Copies of all Photographs taken in Connection with the Mercury Capsule
169	Contour Plots of HF Radiated Patterns
178	Battery Complement Revision

GENERAL ARRANGEMENT
(MERCURY CAPSULE – ATLAS ADAPTER)





B–B



A–A

FIGURE 1

DATE 5 August 1960
REVISED
REVISED
McDONNELL Aircraft Corporation
ST. LOUIS 3, MISSOURI
CONFIDENTIAL
PAGE 8
REPORT 6603
MODEL MERCURY CAPSULE

INTERIOR ARRANGEMENT

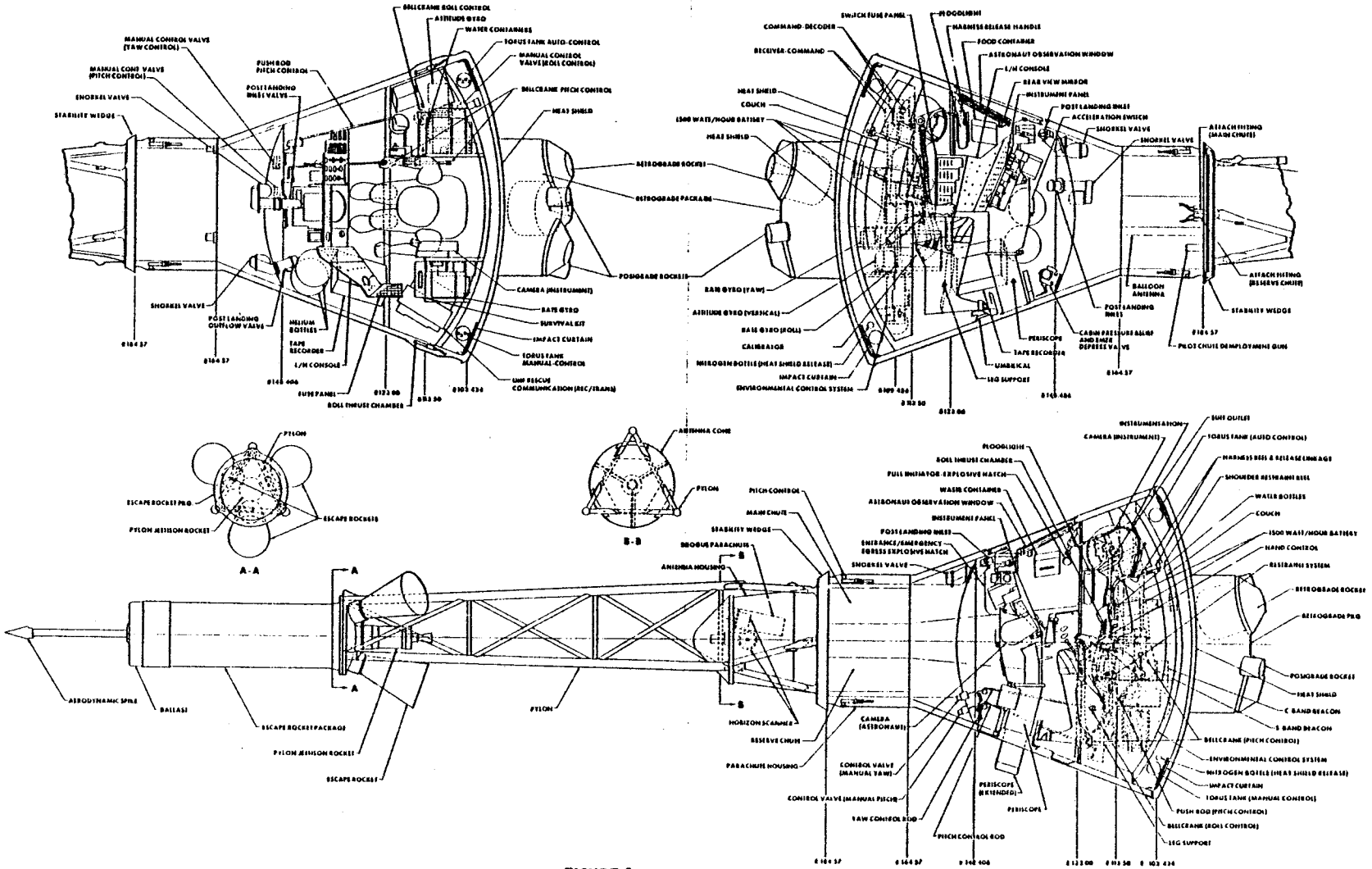


FIGURE 2

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R-2

3.0 REQUIREMENTS -

3.1 CHARACTERISTICS -

3.1.1 WEIGHT AND BALANCE - Specification MIL-W-25140 and Technical Order 1-1B-40 shall be utilized as reference guides.

2.1.2.3 3.1.1.1 GROSS WEIGHT - Current weight breakdown and center of gravity of the capsule as described herein is as shown on the following pages: R-1

2.1.2.3 3.1.1.2 EFFECTIVE LAUNCH WEIGHT - The target value of effective launch weight shall be twenty-seven hundred (2700) pounds. Effective launch weight is defined by the following equation: R-1

$$W_e = W_o + 0.2\, W_j$$

where

W_o = Weight of capsule when projected into orbit.
W_j = Weight of capsule system components jettisoned shortly after release of Atlas booster motors (Atlas staging) and the adapter.

3.1.1.3 ORBIT WEIGHT - Orbit weight is defined as the weight of the capsule when projected into orbit.

3.1.1.4 RE-ENTRY WEIGHT - Re-entry weight is defined as the orbit weight, less hydrogen peroxide (H_2O_2) necessary for normal orbit, and used during re-entry initiation, and less the retrograde rocket assembly.

3.1.1.5 ABORT WEIGHT - Abort weight is defined as the orbit weight of the capsule less the retrograde rocket assembly plus the escape system.

3.1.1.6 IMPACT WEIGHT - Impact weight is defined as the re-entry weight, less the main parachute, antenna cone assembly, all H_2O_2, any ablated material and water used during re-entry. R-1

3.1.1.7 WEIGHT AND BALANCE SUMMARY -

(a) Vehicle Weight Breakdown

R-2

ITEM		WEIGHT	
Structure		585.33	
Adapter-Capsule to Booster		153.80	
Escape System		1014.65	
Heat Shield-Ablation		318.08	
Automatic Control System		92.59	
Reaction Control Group		176.36	
Retrograde System		283.07	
Landing System		247.28	
Instruments and Navigation Equipment		105.51	
Electrical Group		274.13	
Communications		108.25	
Environmental Control System		132.91	
Telemetry and Recording		93.05	
Recovery Gear		31.28	
Crew and Survival		232.47	
GROSS WEIGHT LAUNCH VEHICLE		3848.76	

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued) R-2

(b) Maximum Ablation Condition

ITEM	WEIGHT	C.G.* LOCATION
Gross Weight Launch Vehicle	3848.76	169.74
Less: W_j (Escape Tower)	-1014.65	
Add: 0.2 W_j	202.93	
Effective Launch Weight	3037.04	
Less: 0.2 W_j	-202.93	
Gross Weight in Orbit	2834.11	119.48
Less: Adapter - Capsule to Booster	-153.80	
Posigrade Fuel	-6.24	
Orbit Weight	2674.07	121.50
Less: H_2O_2 - Orient and Orbit	-9.36	
Coolant Water	-9.80	
Retrograde Weight	2654.91	121.62
Less: Retrograde/Posigrade Assembly	-252.73	
H_2O_2 - Retrograde Hold	-10.84	
Re-Entry Weight	2391.34	125.27
Less: Ablated Material	-50.00	
H_2O_2 - Re-Entry Hold	-3.00	
Coolant Water	-2.20	
End of Re-Entry Weight	2336.14	125.88
Less: Nose Cone	-86.45	
Horizon Scanner		
Main Chute Design Weight	2249.69	123.14
Less: Main Chute	-63.02	
H_2O_2 Jettison	-32.20	
SOFAR Bomb	-1.98	
Impact Weight	2152.49	122.06
Less: Reserve Chute	-61.03	
Pilot Chute	-5.11	
Dye Marker	-2.50	
Flotation Weight	2083.85	120.51

* C.G. location is given as Z station. Edge of heat shield is Z = 103.44

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued) R-2

(c) Heat Sink Condition

ITEM	WEIGHT	C.G.* LOCATION
Gross Weight Launch Vehicle	3848.76	169.74
Remove: Heat Shield	-318.08	
Add: Heat Sink	341.53	
Insulation - Large Bhd	6.80	
Heat Sink Att. Ring & Instl	4.26	
Revised Gross Weight Launch Vehicle	3883.27	169.14
Less: W_j Escape Tower	-1014.65	
Add: $.2\,W_j$	202.83	
Effective Launch Weight	3071.45	
Less: $.2\,W_j$	-202.83	
Gross Weight in Orbit	2868.62	119.28
Less: Adapter - Capsule to Booster	-153.80	
Posigrade Fuel	-6.24	
Orbit Weight	2708.58	121.26
Less: H_2O_2 Orient and Orbit	-9.36	
Coolant Water	-9.80	
Retrograde Weight	2689.42	121.38
Less: Retrograde/Posigrade Assy	-252.73	
H_2O_2 Retro Hold	-10.84	
Re-Entry Weight	2425.85	124.96
Less: H_2O_2 Re-Entry Hold	-3.00	
Coolant Water	-2.20	
End of Re-Entry Weight	2420.65	125.00
Less: Nose Cone Assy	-86.45	
Main Chute Design Weight	2334.20	122.32
Less: Main Chute	-63.02	
H_2O_2 Jettison	-32.20	
SOFAR Bomb	-1.98	
Impact Weight	2237.00	121.25
Less: Reserve Chute	-61.03	
Pilot Chute	-5.11	
Dye Marker	-2.50	
Flotation Weight	2168.36	119.73

* C.G. location is given as Z station. Edge of heat shield is Z = 103.44

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued) R-2

(e) Abort Condition

ITEM	WEIGHT	C.G. LOCATION
Gross Weight Launch Vehicle	3848.76	169.74
Less: Adapter - Capsule to Booster	-153.80	
Retrograde/Posigrade Assembly	-258.97	
Abort Weight	3435.99	179.68
Less: Escape Rocket Propellant	-293.20	
Abort Weight - No Fuel	3142.79	165.94
Less: Escape Tower	-721.45	
Re-Entry Weight - Abort Condition	2421.34	125.02

3.2 GENERAL DESCRIPTION -

1.1.3
1.1.7
2.2.1 3.2.1 CONFIGURATION - The capsule configuration shall be of the type shown in Figures 1 and 2 and shall fulfill the requirements specified herein. The complete capsule shall be comprised of the following:

a. Structure (See Paragraph 3.4)

b. Heat and Micrometeorite Protection (See Paragraph 3.6)

c. Booster Adapter and Separation System (See Paragraph 3.7)

d. Pilot Support and Restraint System (See Paragraph 3.8.1 and 3.8.2)

e. Consoles and Controls (See Paragraph 3.8.8)

f. Instrumentation and Display (See Paragraph 3.8.9)

g. Environmental Control System (See Paragraph 3.9)

h. Automatic Control System (See Paragraph 3.10.3)

i. Manual Control System (See Paragraph 3.10.3)

j. Retrograde Rocket System (See Paragraph 3.11)

k. Escape System (See Paragraph 3.12)

l. Power Supplies (See Paragraph 3.13)

m. Communication Equipment (See Paragraph 3.14)

n. Recording Equipment (See Paragraph 3.15)

o. Navigational Aids (See Paragraph 3.16)

p. Landing, Post Landing and Survival System (See Paragraph 3.17)

q. Posigrade Rocket System (See Paragraph 3.11.4)

r. Handling Provisions (See Paragraph 3.18) R-1

s. Pyrotechnics (See Paragraph 3.20)

3.2.2 SELECTION OF MATERIALS - Mission requirements of the capsule dictate use of high temperature resistant materials. Heat resisting materials such as titanium, beryllium, steel, nickel base alloy (Rene' 41), and insulation materials such as Thermoflex, Fiberglas and ceramic coatings shall be used. Where practicable, materials in accordance with the requirements of ANA Bulletins 143d and 147r shall be utilized. R-1

3.2.3 FABRICATION - Structural design concepts of the capsule emphasize employment of proven manufacturing techniques and methods to the greatest possible extent. Maximum use shall be made of developed "off-the-shelf" components fabricated by dependable subsystem manufacturers. McDonnell Aircraft Corporation standards of workmanship, processes and procedures are based on fabrication of production articles according to military standards.

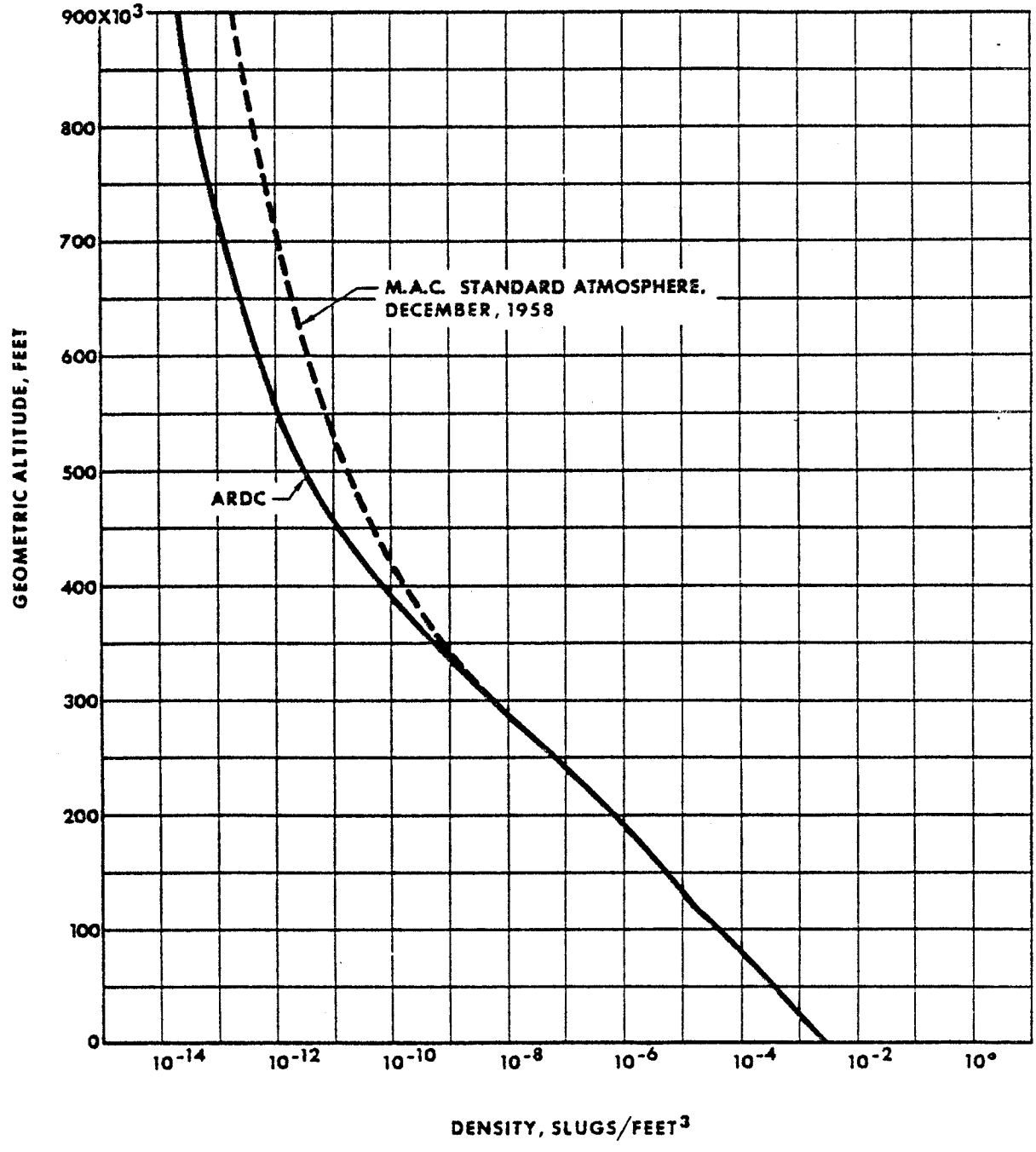
3.2.4 INTERCHANGEABILITY AND REPLACEABILITY - The interchangeability and replaceability intent of Specification MIL-I-8500A(ASG) shall be met on those items of equipment possessing identical physical characteristics and functions in relation to capsule usage as defined in MAC Report No. 6495, revised 1 July 1959. Interchangeability and replaceability requirements are not considered mandatory on basic capsule structure. Interchangeability and replaceability for those equipment items as set forth in this paragraph shall be assured by design requirements, nature of manufacture, and monitoring by contractor personnel, and need not be physcially demonstrated by the exchange or removal of equipment items from the capsule and replacement of these items in a formal demonstration. R-1

3.2.5 FINISH - Definition of finish requirements shall be as specified in the finish specification, McDonnell Drawing No. 45-90000.

3.2.6 IDENTIFICATION AND MARKING - MIL-STD-130 shall be considered as a reference guide in identification of the capsule and capsule components. Marking shall be in accordance with MIL-STD-129B and Specification MIL-M-25047 as applicable. MAC Drawing No. 45-00009 shall define external capsule color requirements and shall specify that the words "UNITED STATES" in six inch (6") block letters, shall be painted on opposite sides of the capsule. Capsule test cable plug or receptacle identification shall be in accordance with MAC Drawing No. 45-00010. R-1

2.1.2 3.2.7 EXTREME ENVIRONMENTAL REQUIREMENTS - Trajectory characteristics
2.7.1 shall be based on the atmospheric density and temperature variations of ARDC 1959 Model atmosphere. Earlier data, as presented in Figure 3, may be used when its use is not critical or when it is compatible with ARDC 1959 Model atmosphere. The capsule, all subsystems, and components shall be designed to withstand the environmental conditions which are expected to be encountered during the mission outlined in Paragraph 1.1.1. R-1

ATMOSPHERIC PROPERTIES



(A) ATMOSPHERIC DENSITY VERSUS GEOMETRIC ALTITUDE

FIGURE 3

3.2.8 LUBRICATION - Lubrication of components where required shall be in accordance with the requirements of Specification MIL-L-6880B. Lubrication data shall be included in maintenance handbooks. No petroleum base lubricants shall be used. Lubricants shall be of the silicone base, fluorolube, oxylube 702, and dry film type. Lubrication shall not cause any toxic or flammable substances to occur in the astronaut's compartment or in the environmental control system. R-1

1.1.7
2.3.2.2.6

3.2.9 RELIABILITY - An integrated reliability program shall be conducted throughout the design, development and fabrication of the Mercury capsule. This shall include the salient features outlined in Specification MIL-W-9411 to the most practicable extent within the scope of the program. The design approach shall emphasize the safety of the mission. Although not specified herein in every instance due consideration shall be given to simplicity, redundancy, and the use of back-up systems in order to improve mission reliability.

2.2.1.4
2.2.1.8
2.1.2.6.5

3.3 AERODYNAMIC AND HYDRODYNAMIC CONSIDERATIONS - The design configuration of the capsule described herein relative to aerodynamic and hydrodynamic considerations has been based on the following:

a. The overall capsule configuration at the time of re-entry shall be statically stable in the heat shield forward attitude. R-1

b. Correct attitude during the re-entry phase shall be facilitated by use of a de-stabilizer flap located on the top of the antenna fairing opposite the roll axis horizon scanner.

c. Supersonic launch and escape drag shall be reduced by use of an aerodynamic spike and ballast assembly located on top of the escape rocket structural assembly.

d. Re-entry forebody shape effect on water and land impact loads.

e. Design landing condition of the capsule has been based on impacts on both water and land, within the structural design parameters defined in MAC Report No. 6693, revised 3 August 1960.

f. The capsule shall be bouyant and hydrodynamically stable upright in the water, impact skirt and heat shield assembly down, and shall be capable of righting itself.

2.4 & Sub. Para.

3.4 STRUCTURAL DESIGN CRITERIA - Structural design criteria of Mercury capsule shall be as defined in McDonnell Aircraft Corporation Report 6693, revised 3 August 1960 and Paragraphs 2.4 through 2.4.2.5 of NASA Specification S-6 revised 26 January 1959. Specifications MIL-A-8629(ASG) and MIL-S-5700 (USAF) series shall be used as reference guides. R-1

3.5 CAPSULE -

2.2.1.1 2.2.1.2 2.2.1.3 2.2.1.7 2.2.1.9 2.4.2.1.1

3.5.1 DESCRIPTION - The Mercury Capsule shall be of a conical configuration having an extremely blunt forebody (in the orbital and re-entry attitudes) with booster adapter attachment fittings and an afterbody which tapers to a juncture with a cylindrical section which shall support a truncated antenna cone and escape system pylon and rockets. The contours of the forebody shall be such as to provide the maximum practical wave drag and uniform surface heating consistent with other requirements. The afterbody configuration shall augment stability and provide adequate volume, and low heating as well as requirements for parachute stowage and escape system attachment. The overall capsule configuration at the time of re-entry shall be stable in the normal re-entry angle of attack. Internal volume of the capsule shall be based on a human occupant five feet ten and one-half inches (5' - 10 1/2") tall and weighing one-hundred and eighty (180) pounds.

2.4.2.1

3.5.2 CONSTRUCTION - The capsule shall be semimonocque titanium construction consisting of a conical and a cylindrical section. The conical section shall consist of an unbeaded inner skin seam welded to a beaded outer skin with 24 equally spaced longitudinal stringers; two bulkheads form the pressurized cabin area. The cylindrical section shall have a single skin with 12 equally spaced stringers and internal shear webs which support the parachutes. The capsule structure shall be protected from heat, noise and micrometeorites by insulation and an outer covering of shingles plus a fiberglass heat shield which shall ablate during re-entry. R-1

3.5.3 ENTRANCE AND EMERGENCY EGRESS HATCH - The entrance and emergency egress hatch, in accordance with MAC Drawing No. 45-32054, located in the capsule conical section, shall be trapezoidal in shape as dictated by the capsule configuration (see Figures 1 and 2). The hatch assembly shall be of construction similar to the basic capsule structure and has been designed for entry into the capsule and for emergency egress in event of a land impact. An explosive assembly in accordance with MAC Drawing No. 45-35701 shall be incorporated in the hatch assembly to serve as a means, when ignited, of breaking the seventy (70) hatch attachment bolts. The explosive assembly shall be mounted about the hatch perimeter and shall consist of a gasket type sill containing four (4) parallel strands of explosive charge to effect severance of the special notched attachment bolts. Two (2) strands of explosive powder shall be located beneath the bolt heads on each side of the bolt shank. All four (4) strands shall be ignited from both ends simultaneously to provide redundancy. A pull initiator shall be provided on the hatch interior to the astronaut's upper right. This shall include a "T" handle and cable assembly, which when pulled by the astronaut shall ignite the explosive charge. An additional pull initiator assembly shall be provided on the exterior of the hatch beneath the shingles for ground rescue utilization. Function of this assembly shall be the same as for the astronaut actuated initiator. A cabin pressurization tire-type valve shall be located in this hatch to permit a ground leakage check of the hatch seal prior to launch. After completion of the leakage check, the valve shall be sealed. R-1

2.4.1.3.2.5 3.5.4 EXIT HATCH - The exit hatch in accordance with MAC Drawing No. 45-32023 shall be located in the small afterbody pressure bulkhead. The hatch shall be dish-shaped and shall be an inward opening, plug type hatch of reinforced titanium construction. The hatch shall be held in place by a retaining ring which, when latched in place, shall cause the hatch to seal to the small pressure bulkhead. The retaining ring shall consist of a partial ring so that as the latch handle is actuated to the closed position, tension shall be applied to the ring, forcing the ring ends together to form a tight seal. As the latching handle linkage is released to the open position, the ring ends shall separate, releasing the tension. In order to facilitate egress through the exit hatch, the right section of the instrument panel has been designed for removal. The periscope housing may be used as a step during egress. The exit hatch shall remain operable after a normal land impact. R-2

2.4.2.1.1 3.5.5 WINDOWS AND COVERS - R-1

3.5.5.1 WINDOW - An observation window assembly shall be provided for astronaut visual observation of the space environment. This assembly shall be located in the afterbody conical section forward of and above the astronaut's head from stations Z124.81 to Z144.80. The window assembly shall consist of an outer window assembly in accordance with MAC Drawing No. 45-35030 and an inner window assembly in accordance with MAC Drawing No. 45-35035. Window shape shall be trapezoidal as dictated by the capsule conical configuration with the base of the trapezoid toward the heat shield end as indicated in Figures 1 and 2 herein. The outer window assembly shall consist of a single pane of 0.350 inch Vycor glass contoured to the capsule structural shell curvature. The outer pane shall possess grade 3N optical fidelity in relaxed areas and grade 2N optical fidelity in its two critical areas. Grade 3N glass shall permit an optical deviation of 3 minutes of arc and grade 2N glass shall permit an optical deviation of 2 minutes of arc. Location of critical areas shall be such as to be compatible with reference sight lines on the inner window assembly. The outer pane shall be mounted in a structural frame, with suitable sealing gaskets on the inner and outer surfaces and spacers supporting the edge inside the frame. The inner window assembly shall consist of three (3) flat panes of glass of the trapezoid configuration, each having an optical fidelity of grade 2N. The two (2) inner panes shall be 0.340 inch tempered glass and the outermost pane of the inner window assembly shall be 0.170 inch Vycor glass. The outermost pane shall contain lateral reference sight lines on the inner and outer surfaces as required by the window mounting angle and the fixed optical reference point. The set of lines near the base of the trapezoidal pane shall provide an eye level sight reference for viewing the horizon compatible with the capsule retrograde attitude of minus thirty-four (-34) degrees. The second set of lines shall provide an eye level reference for viewing the horizon compatible with the capsule orbital attitude of minus fourteen and one-half (-14.5) degrees from horizontal, heat shield up. The inner window panes shall be mounted in individual supporting rings, independently sealed by

3.5.5.1 WINDOW - (Continued)

gaskets on upper and lower surfaces and held firm by spacers around the edge inside the ring. The pane assemblies shall be supported by a structural frame which shall be attached and sealed to the capsule inner structure. The inner surface of the outer window pane and both surfaces of the inner window assembly panes shall be coated with a single layer of magnesium fluoride (MgF_2) film for impeding thermal radiation in the cabin. A light-polarized, transparent filter, in accordance with MAC Drawing No. 45-86034, shall be provided and retained on the inner frame of the observation window for multiple image suppression and improvement of observation characteristics.

3.5.5.2 COVER - A cover and filter assembly shall be provided for the observation window in accordance with MAC Drawing No. 45-86005. This assembly shall be mounted on the inner window assembly as described in Paragraph 3.5.5.1 and shall offer protection from solar radiation and boundary layer effects during the re-entry mode. The cover assembly shall consist of a right and left door of aluminum alloy, honeycomb core, construction configured to the shape of the trapezoidal window assembly. Each door shall be hinged on its outboard side and shall contain a latching mechanism and handle for actuation. The doors shall be retained in the outboard, open position by latches located on each side of the capsule. The filter assembly shall consist of a right and left plexiglass panel 0.080 inch thick configured to the shape of the window assembly. Each plexiglass panel shall be hinged on its outboard side and shall contain a rubber sealing strip about the inboard and lower edges. The filters shall be retained in the closed position by a spring-loaded latch located above and forward of the astronaut's head. The astronaut must pull the latch assembly in order to release the filters to the open position where they may be latched on each side of the capsule with the cover assembly doors. The filter plexiglass panels shall be red in color to afford the astronaut a means of adapting from a night-day environment during the orbital cycles. The filter panels shall be equal to or of optical quality superior to Plex II in accordance with Specification MIL-P-5425B, Finish A, except for the light transmissibility characteristics required for filtering capabilities. An extended view mirror assembly shall be provided with the cover assembly. The mirror assembly shall be located on the lower end of the inner window assembly and shall mate with the filter assembly sealing strips. The mirror shall be of aluminum alloy construction with a reflecting surface which shall permit a maximum image shift approximating .09 inch a twenty-five (25) feet when viewed at eighteen (18) inches. The mirror shall contain a ring type handle for the astronaut to grasp when an extended view of the horizon is desired. The cover and filter assembly shall be accessible to the astronaut in the fully restrained and pressurized condition. A window pole assembly in accordance with MAC Drawing No. 45-81092 shall be provided to assist the astronaut in actuation of the cover and filter assembly latches. The window pole assembly shall be retained on the capsule inner structure by a spring detent which shall be located to the astronaut's left. The handle of the pole shall be attached to the capsule by a cord. R-1

3.5.6 ANTENNA FAIRING - An antenna fairing, in accordance with MAC Drawing No. 45-31003, shall be installed between the cylindrical recovery compartment and the escape tower and shall extend from Sta. Z184.57 to Z208.57. The antenna fairing shall house the pitch and roll horizon scanners. An eight (8) inch window assembly consisting of a silicone base, fiberglass insulation, vycor glass, and teflon strips, shall be located around the outer base of the antenna fairing and shall act as a dielectric for the main biconical antenna. A destabilizer flap assembly, in accordance with MAC Drawing No. 45-31026, shall be attached to the upper extremity and outer edge of the antenna structural assembly opposite the roll horizon scanner. The destabilizer flap shall provide correct re-entry attitude during capsule abort and re-entry phases. Prior to capsule-tower separation, the destabilizer flap, which shall be spring loaded to the outboard position, shall be held flat against the antenna fairing by means of a quick release pin attached to the escape tower. The flap shall be released upon escape tower jettison. The antenna fairing shall be automatically jettisoned from the capsule as the capsule descends to 10,000 feet altitude. (See Paragraph 3.17.1.2).

3.6 HEAT AND MICROMETEORITE SHIELDING -

2.2.1.11 2.4.2.2 3.6.1 FOREBODY HEAT PROTECTION - The capsule shall be protected by a dish-shaped ablative type heat shield which shall form the forward surface (forebody) of the capsule. The heat shield, in accordance with MAC Drawing No. 45-32052, shall be designed to ablate heat and shall be constructed of fiberglass shingles laminated to form a smooth contour in its final size of 74.44 inch diameter with an 80 inch spherical radius. The heat shield shall also provide protection from loads imposed by launching accelerations, retrograde rocket firing, parachute deployment and dynamic air loads. Design consideration has been given to landing loads on the heat shield to insure that the pressure vessel is not punctured on water landings and that internal equipment is not damaged upon land impact. These design considerations were based on retention of the heat shield to the capsule, whereas the heat shield shall be released from the capsule as a result of installation of a landing impact skirt assembly as described in Paragraph 3.17. The landing impact skirt assembly shall reduce landing impact loads. The heat shield shall be attached to the capsule conical structural assembly (afterbody) by a titanium heat shield attach ring. The attach ring, riveted to the capsule structure assembly, shall contain 48 elongated holes (to allow for thermal expansion) to mate with bolt holes spaced about the rim of the heat shield. The heat shield shall be joined to the attach ring by 24 locking studs alternated with 22 guide studs with 2 holes remaining unused beneath the heat shield release mechanism actuators. Actuation of the heat shield release mechanism shall initiate withdrawal of its 24 "U" shaped slides, releasing the 24 lock studs and the heat shield from the capsule structural assembly. The impact skirt shall be attached to the heat shield by a retainer ring containing holes to mate with 219 equally spaced helical coil inserts in the inner edge of the heat shield on a radius of 34.98 inches from the Z axis. R-2

2.4.2.1.1 2.4.2.2 2.4.2.2.1 2.4.2.3 3.6.2 AFTERBODY HEAT PROTECTION - Afterbody heat protection shall consist of a radiation shield on the outside surface with insulation between this shield and the primary structure. The radiation shield shall be composed of numerous individual corrugated shingles attached by bolts through oversize holes to allow thermal expansion while remaining within acceptable flutter limits. Shingle material shall be Rene' 41 on the antenna fairing and conical afterbody section and beryllium on the cylindrical recovery compartment. Thermal leakage to the inner structure shall be minimized by using insulation between the outer and inner skin. This insulation shall also serve to attenuate the external noise level. R-1

2.4.2.2 3.6.3 MICROMETEORITE PROTECTION - Protection of the underlying pressure of capsule against impacts from micrometeorites shall be provided by the use of the corrugated shingles specified above. R-1

2.4.2.5
2.1.2.2
1.1.6

3.7 MISSILE ADAPTER - MAC shall be responsible for matching the Mercury capsule to an Atlas D missile, the Mercury booster vehicle (HS-36). The capsule shall replace the missile nose cone in a manner which requires a minimum of modification to the booster system. The booster adapter, in accordance with MAC Drawing No. 45-33002, for mating the Mercury capsule to the booster vehicle shall be of conventional semimonocoque aluminum, steel, and titanium construction. The adapter shall consist of a machined structural frame utilizing a capsule match ring and a missile adapter ring, with titanium sheet metal skin reinforced by longitudinal hat sections spaced about the inner surface. The adapter shall have ventilation provisions for booster vehicle LOX environmental relief and pressure equalization during launch. The adapter shall be attached to the capsule by a clamp ring installation in accordance with MAC Drawing No. 45-72010. The clamp ring installation shall consist of three (3) segmented sections joined by three (3) explosive tension bolts. Two (2) explosive bolts can be initiated electrically from either end by a dual electrical system. The third explosive bolt may be initiated electrically from one end and by a percussion initiator system which shall be used to supply a gas generator source to the opposite end for initiating the bolt. Automatic capsule adapter separation shall be initiated by placing the SQUIB ARM switch on the main instrument panel in the ARM position prior to launch. Upon sustainer engine thrust decay to 0.20g as sensed by the capsule contained cutoff sensor, the 0.20g contacts shall close, energizing the capsule adapter clamp ring bolts relay, which shall initiate detonation of the explosive bolts. R-1 Separation of the clamp ring bolts shall close the capsule adapter ring separation limit switches. This action shall initiate a firing signal to the posigrade rockets (see Paragraph 3.11.4). In event the automatic system does not function as indicated by the telelight sequence system (see Paragraph 3.8.9.4), an override control shall be provided. This override control shall consist of a pull ring which must be actuated by the astronaut. Pulling the handle shall actuate a limit switch which shall energize a redundant electrical system for detonation of two (2) of the explosive bolts and shall actuate an initiator for firing of the third explosive bolt. Detonation of any one explosive bolt shall separate the clamp ring. Capsule adapter separation can be initiated by ground command (G-1 on the sequential schematic, Figure 6, Page 67) through abort circuitry.

INSTRUMENT PANEL AND CONSOLES

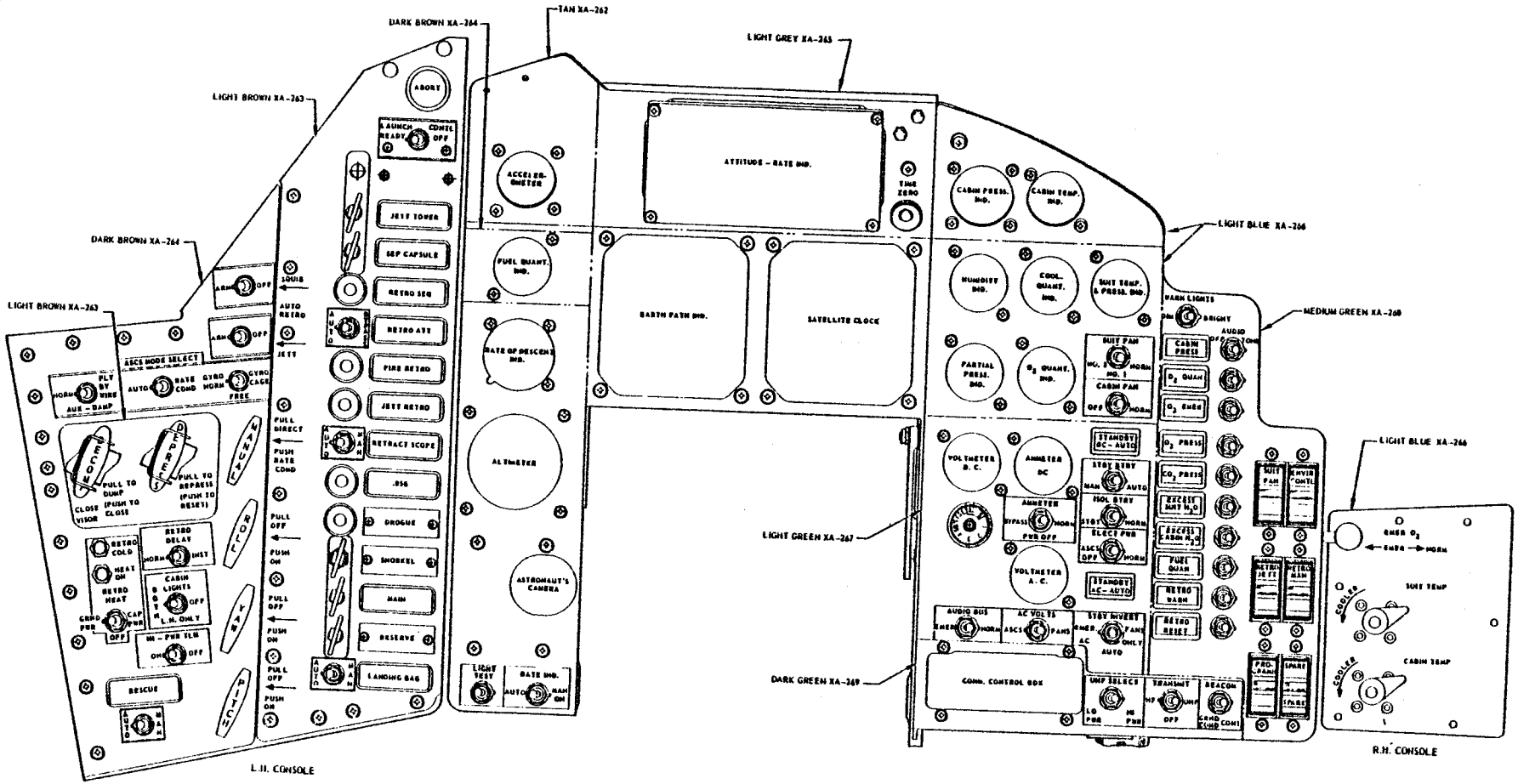


FIGURE 4

2.5.4 2.5.4.1 3.8 CREW STATION - The location and actuation of all astronaut operated controls, and the arrangement of instruments and warning devices shall be in accordance with good human engineering practice. Restrictions imposed on the astronaut by the restraint system, pressure suit and acceleration forces have been considered in crew station design. R-1

2.5.2 2.5.2.1 2.5.2.3 2.5.2.4 2.5.2.5 2.5.2.6 2.5.2.8 2.5.2.2 2.5.3.1.1 3.8.1 ASTRONAUT SUPPORT COUCH - Each astronaut shall be provided with an individually molded support couch consisting of a contoured seat assembly in accordance with MAC Drawing No. 45-82000 and leg restraint assembly in accordance with MAC Drawing No. 45-82002. Seat and leg restraint assemblies shall be shipped from the contractor's plant to the launch site for installation. R-2 The seat assembly shall support the astronaut's torso, arms to a point just below his elbows, and head, and the leg restraint assembly shall support his thighs and calves. Left and right hand arm rests shall be provided with the seat installation. Each seat shall be fabricated in accordance with MAC Process Specification P.S. 14043.

3.8.1.1 CONSTRUCTION - Seat construction primarily shall be of glass fiber plastic laminate in accordance with MAC Material Specification MMS-501, aluminum alloy honeycomb core in accordance with MAC Material Specification MMS-701, glass fabric laminate, aluminum alloy, plastics, fiberglass and lockfoam filler. Each seat assembly shall consist of an inner liner and outer shell assembly with the area between filled with lockfoam plastic. The inner liner shall be of glass fiber plastic laminate and glass fabric laminate molded to the astronaut's body as specified in the preceding paragraph. The outer shell shall be constructed of laminate skin, honeycomb core sandwiches formed to the curvature of the large pressure bulkhead on the back; to the contour of the inner liner on the bottom and roughly to astronaut's helmet and shoulders on the head assembly; and, to the vertical seat support beam assemblies to the left and right of center. The sandwiches shall be joined by formed laminate skin, plastic compound filled angles, and aluminum alloy rub strips. A glass fiber plastic laminate restraint harness support fitting shall be provided on each side of the seat assembly. The leg restraint assembly shall be constructed of glass fiber plastic laminate, glass fabric laminate, fiberglass, aluminum alloy and lockfoam plastic filler. Each leg restraint assembly shall consist of inner liners and outer shell support assemblies with the area between filled with lockfoam plastic. The inner liners shall be constructed of glass fiber plastic laminate and glass fabric laminate molded to the astronaut's body as specified in the preceding paragraph. The outer shell support assemblies shall consist of formed aluminum alloy thigh supports and formed fiberglass leg supports. The thigh portions of the restraint assembly shall be hinged to the seat and calf restraint assemblies, and the calf restraints shall be hinged at the ankle ends. Hinging of these assemblies shall permit installation through the entrance hatch.

3.8.1.1 CONSTRUCTION - (Continued)

Loads from the astronaut shall be transmitted through the inner liners which shall act as distribution panels to the honeycomb structure. Crushable support assemblies constructed of aluminum alloy honeycomb glass fiber laminate shall be installed between the large pressure bulkhead and the seat assembly. The honeycomb core construction employed in the seat support assemblies shall decrease the loading on the astronaut because of excessive positive transverse accelerations and provide adequate protection against pathological damage and loss of consciousness when subjected to peak positive accelerations as dictated by the mission as defined in Paragraph 1.1.1 herein. The seat design shall be such as to provide adequate support under conditions of lateral acceleration.

2.5.2
2.5.2.7
2.5.4.1

3.8.2 ASTRONAUT RESTRAINT SYSTEM - The astronaut shall be firmly restrained in the support couch by a restraint harness assembly in accordance with MAC Drawing No. 45-82702. The restraint harness shall provide satisfactory support for conditions of maximum acceleration and shall consist of two (2) shoulder harness assemblies, a chest strap, a lap belt assembly, an inverted crotch strap assembly, and a knee belt assembly. Webbing shall be of dacron material in accordance with Specification MIL-W-25361. The shoulder harnesses shall be of the conventional type and shall be held in tension automatically by spring loaded reels. During ascent and descent, the reels shall be locked in the fully restrained position to prevent astronaut movement out of the support couch. When unlocked, for the normal restrained position, the reels shall provide a light restraining force to aid positioning and to provide the astronaut with proprioceptive cues during weightless flight. Reel locks shall be disengaged by actuation of a control lever located to the upper left of the seat assembly. The lap belt shall be of conventional type with a center coupling. Eyelets on the shoulder harness straps and inverted "V" crotch strap shall loop the lap belt coupling so that disconnecting the lap belt coupling will release lap belt, shoulder harness, and crotch straps. The lap belt shall have quick release end fittings on each end for ease of installation in the capsule. Leg restraint shall be provided by a knee belt assembly consisting of dacron straps formed to knee cups with retainer straps on each side attached to fittings on the seat assembly and to a fitting located at a central point (Sta. X0.00) between the astronaut's legs. Toe restraint shall be provided by insertion of the astronaut's flight boots into toe restraint supports in accordance with MAC Drawing No. 45-32207, and constructed of laminated plastic conforming to MAC Material Specification MMS-501. Arm and hand restraint shall be provided by the astronaut's gripping the manual control handle to his right and the abort handle to his left. R-1

2.5.5.1.1 3.8.3 ASTRONAUT APPAREL - The pressure suit and helmet worn by the astronaut shall be furnished by NASA. The pressure suit shall be a Goodrich-Mercury type and shall include connections to mate with capsules for biomedical measurements, oxygen breathing and face piece seal lines and communications. R-2

2.5.1.1.8 2.5.4.1 3.8.4 FOOD AND WATER - The contractor shall make installation provisions for a food container to be furnished by NASA. (See Appendix I-A.) The container shall allow proper storage and dispensing during flight and shall be located to the astronaut's right between the hand controller and right-hand console. Food shall be of the low residue type and shall be furnished by NASA for the mission as defined in Paragraph 1.1.1. Two three (3) pound capacity plastic water containers in accordance with MAC Drawing No. 45-81708 shall be provided. Each container shall be securely mounted by four bolts and plate-nuts on the vertical panel to the right of the astronaut's support couch in a manner such that there shall be no interference from any structure. Each shall be equipped with a retracting drinking tube, so that the astronaut shall be able to easily transfer water from the container to his mouth. The container shall be designed so that capsule gases cannot mix with the water and such that drinking can be accomplished under conditions of zero gravity. The survival kit shall contain a desalting kit for water supply after a water landing (See Paragraph 3.17.3). R-2

2.5.1.1.9 3.8.5 WASTE HANDLING - Provisions shall be made for urine collection within the pressure suit. A canvas bag assembly with a water-proof inner bag assembly, in accordance with MAC Drawing No. 45-81230, shall be provided and mounted on the hatch for use by the astronaut in event nausea is experienced during any phase of the mission. R-2

3.8.5.1 KNIFE INSTALLATION - A knife installation shall be provided in accordance with MAC Drawing No. 45-81102. The knife installation shall be mounted on the hatch assembly to the upper right of the astronaut. The knife shall be restrained in its bracket assembly by a retention strap and to the hatch by a spring. The knife shall be attached to its bracket assembly by a cord assembly which shall prevent the knife from floating while in a zero g condition if it becomes detached from the retention strap and spring. The knife shall be furnished by NASA (See Appendix I-A).

3.8.5.2 FLASHLIGHT INSTALLATION - A flashlight installation shall be provided in accordance with MAC Drawing No. 45-81098. The flashlight shall be mounted on the capsule inner structure forward and to the left of the astronaut. The flashlight shall be retained in a bracket assembly and spring clip type stop. A cord assembly shall be attached to the flash-light and its supporting bracket assembly. This shall prevent the flashlight from floating while in a zero g condition. The flashlight shall be furnished by NASA (See Appendix I-A).

2.5.1.2.6 3.8.6 NOISE AND VIBRATION - The anticipated noise level which shall reach the astronaut is estimated to be below 135 decibels during maximum "g" conditions. Noise levels shall be attenuated by the cabin insulation and by the astronaut's apparel. The noise attenuation provided shall be great enough to permit two-way communication by proper selection of microphones and earphones. Vibrations imposed shall be lessened by absorption through the support couch. Sound level and vibration measurements shall be made by the systems described in paragraph 3.15.5 herein. R-2

2.6.2 2.6.3.2 3.8.7 AERO-MEDICAL SENSING EQUIPMENT - Aero-medical sensing equipment shall consist of the following. Instrumentation shall be as specified in Paragraph 3.8.9 and as depicted in Figure 8, page 82. R-2

2.6.2 2.6.3.2 2.6.3.2.1 3.8.7.1 ELECTROCARDIOGRAM - Indications of EKG shall be provided by three normal leads. These shall provide two outputs for telemetering on each telemeter system. One output shall be derived from a left shoulder and a right shoulder lead; and the other from a right shoulder and a left thigh lead.

2.6.2 2.6.3.2.1 3.8.7.2 RESPIRATORY MEASUREMENT - Respiratory measurement shall be made by means of a harness containing a transducer for determining the Astronaut's chest expansion. R-2

2.6.2 3.8.7.3 BODY TEMPERATURE - A rectal temperature pick-up shall be provided for recording the Astronaut's body temperature. R-1

3.8.8 CONSOLES AND CONTROLS -

3.8.8.1 CONSOLES -

3.8.8.1.1 RIGHT-HAND CONSOLE - The right-hand console in accordance with MAC Drawing No. 45-81002 shall contain controls for cabin temperature, suit temperature and oxygen supply. These controls shall be accessible to the astronaut while in the fully pressurized condition. The right-hand console shall be finished in light blue space capsule coating XA-266 compatible with the life support color code as applied to the main instrument panel. R-2

3.8.8.1.2 LEFT-HAND CONSOLE - The left-hand console in accordance with MAC Drawing No. 45-81100 shall consist of two panels; the inner panel adjoining the instrument panel which shall contain the abort light, launch control switch, and sequence system with manual override controls (see Paragraph 3.8.9.4); and, the outer panel which shall contain the squib arm switch, auto retro jettison arm switch, ASCS mode select switches, ASCS manual controls, retro heat and delay switches, pressurization controls, rescue aids switch, telemetry switch and cabin lights switch. The left-hand console inner panel shall be finished in light brown space capsule coating XA-263 and the outer panel shall be finished in dark brown space capsule coating XA-264, except for the pressurization controls area which shall be finished in light brown XA-263 with the handles finished in red space capsule coating XA-214.

3.8.8.2 CONTROLS - In addition to the console controls specified in the preceding paragraphs, the astronaut shall be provided with an abort handle to his left and with a manual control system hand controller to his right. R-1

2.3.3.1
2.3.3.2
2.3.3.2.1
2.3.3.2.2
2.3.3.2.4

3.8.8.2.1 HAND CONTROLLER - The manual system hand controller, in accordance with MAC Drawing No. 45-61010, shall provide the astronaut a means of manually controlling the capsule attitude in three (3) axes. The hand controller shall be operable to the astronaut while in the restrained condition through wrist articulation and palm pivot motion only, but shall be structurally designed for full astronaut effort. The hand controller shall be stick grip type control which can be positively latched in the neutral position during launch operation, providing a firm hand hold for the astronaut. Latching and release of the hand controller shall be through actuation of a pin and trigger assembly located at the forward base of the grip. Dropping the hand below normal position and squeezing the trigger with the little finger shall trip the trigger mechanism, releasing the pin assembly through a hole in the handle assembly and locking the handle. To unlock the controller, the astronaut must pull the pin in an upward motion until the trigger re-engages an annular detent in the pin. The manual control system hand controller shall be designed to minimize longitudinal acceleration control forces, R-2

3.8.8.2.1 HAND CONTROLLER - (Continued)

and shall be spring loaded to provide a "feel" system. By switching the ASCS mode select switch (P-19) on the sequential schematic, Figure 6 Page 67) to the "fly-by-wire" position, the astronaut may selectively energize the solenoid valves of the automatic reaction control subsystem through limit switches actuated by the hand controller. This shall provide the "fly-by-wire" mode through utilization of automatic control system fuel while bypassing the system's inherent electronics (see Paragraph 3.10.1.1). Controller motions of approximately 25 per cent and 75 per cent of travel shall activate the small and large thrust reaction control solenoid valves respectively. The hand controller shall be connected to the modulated manual control valves in the reaction control system by conventional linkage, which shall be covered with fabric boots to provide protection from fouling by floating debris.

Total travel of the hand controller shall be ± 13 degrees from neutral in roll and pitch axes and ± 10 degrees in the yaw axis. Actuation in an up and down direction about a pivot at the wrist, shall provide an upward and downward movement about the capsule pitch axis. Rotary displacement in a clockwise or counter-clockwise direction in a transverse plane with respect to the pivot point below the astronaut's wrist shall provide a similar movement about the capsule roll axis. Actuation of the stick grip by palm pivot motion in a right or left direction shall provide a similar movement about the yaw axis. R-1

3.8.8.2.2 ABORT HANDLE - The abort handle, in accordance with MAC Drawing No. 45-61002, shall provide the astronaut with a means of manually initiating the escape sequence. The abort handle shall be located on the astronaut's left and shall be operable to the astronaut while in the restrained condition. The handle shall be a stick type, flanged at the upper extremity to prevent the astronaut's hand from inadvertently slipping off. A recessed unlock button, which must be depressed to release the handle for actuation, shall be located on the top. A "mike" button, accessible for thumb operation, shall be provided on the upper end of the handle adjacent to the handle release button. The handle when rotated twenty-seven (27) degrees in a counterclockwise direction about its pivot point, shall initiate the escape sequence. R-2

3.8.9 INSTRUMENTATION AND DISPLAYS - A main instrument panel assembly in accordance with MAC Drawing No. 45-81100 shall be provided for astronaut indication of emergency, environment, vehicle and operational measurements. The instrument panel shall be supported from capsule structure on the upper left and by the periscope housing (see Paragraph 3.16.1). The instrument panel shall extend around both sides and the top edge of the periscope such that the scope display shall appear in the lower center of the instrument display. This installation shall provide an optical reference R-2

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

point which falls at the intersection of Stations FZ135.59 and TY5 .780. All instruments shall have white indices on black background. The instrument panel shall be coded to indicate specific functional areas by color. These shall be as follows:

FUNCTION	SPACE CAPSULE COATING
Life Support	Light Blue XA-266
Electrical	Light Green XA-267
Radio	Dark Green XA-269
Warning	Medium Green XA-268
Flight	Light Grey XA-265
Altitude and Descent	Tan XA-262
Fuel Indication	Dark Brown XA-264

R-1

Basic instrumentation, depicting transmitting and/or recording methods for obtaining measurements defined below are as illustrated in Figure 8, Page 82 . Instrumentation specified below shall be provided by the contractor, except for cosmic ray recorders which shall be furnished by NASA.

6.2.1

(a) Aero-Medical	Astronaut's Indication	Recording Method (See Figure 8)
Electrocardiogram	-	X
Respiratory Rate	-	X
Body Temperature	-	X
Astronaut Motion and Appearance	-	X
Voice Recording	X	X

2.6.2.2

(b) Capsule Environment		
O_2 Partial Pressure	X	X
CO_2 Partial Pressure	X	X
O_2 Supply Pressure	X	X
O_2 Emergency Supply Pressure	X	X
Cabin Pressure	X	X
Cabin Air Temperature	X	X
Instrument Panel Recording	-	X
Noise Level	-	X
Emergency Oxygen Usage	X	X
O_2 and Coolant Quantity	X	X
Pressure Suit Inlet Air Temperature	-	X

R-1

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

	Astronaut's Indication	Recording Method (See Figure 8)	
Vibration	-	X	
Humidity	X	X	R-1
Suit Temperature and Pressure	X	X	
2.6.2.3 (c) Vehicle Measurements			
Acceleration (See Paragraph 3.8.9.3)	Long. Only	X	
Time Reference (See Paragraph 3.8.9.1)	X	X	
Static Pressure	-	X	R-2
Structural Temperatures	-	X	
Astronaut Control Motions (Pitch, Roll and Yaw)	-	X	
Stabilization Control Motions (Pitch, Roll and Yaw)	-	X	
Visual Attitude Reference (See Paragraph 3.16.1)	X	X	
Attitude and Angular Rate (See Paragraph 3.8.9.2)	X	X	
Altitude (Altimeter)	X	X	
Dead Reckoning Earth Path (See Paragraph 3.8.9.6)	X	X	
Rate of Descent	X	X	
Velocity Increase-Posigrade Rockets (See Paragraph 3.11.4)	-	X	
Velocity Decrement - Retrograde Rockets (See Paragraph 3.11.3)	-	X	
2.6.2.4 (d) Operational Measurements			
A.C. Voltage	X	X	
D.C. Voltage	X	X	
Sequence of Events (See Paragraph 3.8.9.4)	X	X	
System Malfunction (See Paragraph 3.8.9.4)	X	X	
Reaction Gas Quantity	X	X	
D.C. Current	X	X	
2.6.2.5 (e) Scientific Observations			
Cosmic Radiation	-	X	R-1

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

	Astronaut's Indication	Recording Method (See Figure 8)
(f) Emergency Alarms		
Cabin Pressure	X	X
O_2 Quantity	X	X
O_2 Emergency	X	X
O_2 Pressure	X	X
CO_2 Pressure	X	X
Excess Suit H_2O	X	X
Fuel Quantity	X	X
Retro Warning	X	X
Retro Reset	X	X

3.8.9.1 SATELLITE CLOCK - A satellite clock in accordance with MAC Drawing No. 45-81710 shall be provided. This clock, a spring-driven chronometer, shall indicate time of day, elapsed time from launch, retrograde event time, retrograde time-to-go, and artibrary elapsed time (stop watch). A time zero reference shall be established in the clock at lift-off (eight (8) inches off the pad). The retrograde timing mechanism shall provide a retrograde fire signal at retrograde time-to-go zero. Signals of elapsed time from start of boost and retrograde time shall be transmitted to telemetry as indicated in Figure 8, page 82 . The retrograde set indicator which may be reset manually or by ground signals shall provide ground monitored automatic retrograde firing. The "time-to-go" dial light shall be internally lighted yellow for a period of 5 minutes prior to the event time.

3.8.9.2 ANGULAR RATE AND ATTITUDE INDICATOR - A combined angular rate and attitude indicating system shall be provided in accordance with MAC Drawing No. 45-81721. This indicator shall indicate pitch, roll and yaw angles and angular rates. Pitch angles shall be indicated in the range of -130 degrees to +190 degrees. Yaw angles shall be indicated in the range of -70 degrees to +250 degrees. Roll angles shall be indicated in the range of -130 degrees to +190 degrees. The pitch needles shall be color coded pink, the yaw needles shall be color coded yellow, and the roll needles shall be color coded blue. Colors shall be in accordance with FED-STD-595. The attitude portion of the indicator shall be driven by synchro signals obtained from the automatic stabilization and control system (See Paragraph 3.10.1). Angular rates shall be indicated within a total range of ±6 degrees per second. The retrograde index point on the indicator shall be compatible with the zero pitch rate at -34 degrees on the pitch indicator dial. This indicator shall provide the astronaut with necessary indications so that he may damp out dynamic oscillations in event of malfunction of the automatic stabilization and control system.

2.6.2.3

3.8.9.3 ACCELERATION INDICATION - An accelerometer in accordance with MAC Drawing No. 45-81702 shall be provided for the longitudinal axis only. The modified standard accelerometer, in accordance with Specification MIL-A-25719, shall include positive and negative "g" memory pointers. R-1

3.8.9.4 SEQUENCE SYSTEM AND OVERRIDE CONTROLS - The sequence system shall consist of engraved nameplates and telelight sequence lights with adjacent manually operated override controls. This system shall indicate functional sequence of events by illumination of a green light for normal sequential operation or, after a time delay, by a red light indicating a malfunction and need for subsequent override action. After corrective action has been taken, the telelight shall illuminate green as in normal sequential operation. In order of chronology, the following shall appear on the left-hand console: R-2

NOMENCLATURE	OVERRIDE CONTROL	SWITCH NO.	PRESENTATION	
Launch Control	Toggle Switch	P-1	Engraved Nameplate	
Jett Tower	Pull Ring	P-3	Telelight	R-1
Sep. Capsule	Pull Ring	P-4	Telelight	
Retro Seq.	Push Button	P-6	Telelight	
Retro Att.	Toggle Switch	P-8	Telelight	
Fire Retro	Push Button	P-7	Telelight	
Jett Retro	Push Button	P-10	Telelight	
Retract Scope	Toggle Switch	P-20	Telelight	
.05g	Push Button	P-11	Telelight	
Drogue	Push Button	P-12	Engraved Nameplate	
Snorkel	Pull Ring	- - -	Engraved Nameplate	
Main	Pull Ring	P-13	Telelight	
Reserve	Pull Ring	P-14	Engraved Nameplate	
Landing Bag	Toggle Switch	P-25	Telelight	
Rescue	Toggle Switch	P-15	Telelight	

Switch numbers represent manual override controls and correspond to those indicated in the sequential schematic, Figure 6, Page 67.

The remaining pull ring override controls shall provide override functions by dual independent electrical systems or by pyrotechnic initiators. The guarded push button controls shall provide override control by a dual electrical system for each function designated. The toggle switches shall function in a left-right direction and their nomenclature shall be as follows (in order of sequence and left-right readings):

Launch Control "Ready-off"

3.8.9.4 SEQUENCE SYSTEM AND OVERRIDE CONTROLS - (Continued)

Retro Att.	"Auto-Bypass"
Retract Scope	"Auto-Man."
Landing Bag	"Auto-Man."
Rescue	"Auto-Man."

The telelight assemblies in accordance with MAC Drawing No. 45-79720, shall be rectangular in shape and shall consist of red and green light assemblies, nomenclature caps and retention clips. Legends shall be direct reading, engraved in black on frosted glass plate nomenclature caps and shall be readable when the lights are de-energized. Colors shall be in accordance with FED-STD-3. Brightness of the lights shall be as required by MIL-STD-411 for 24 volts application.

The engraved nameplates shall be constructed of aluminum material and shall simulate the telelight assemblies in form and size. Nomenclature on the nameplates shall be white on a black background.

3.8.9.4.1 WARNING LIGHTS - Warning lights shall be provided on a warning light panel located on the right-hand side of the instrument panel, except for the "Abort" light which shall be located on the left-hand console above the sequence system. The "Abort" light shall be a round presentation, 1.5 inches in diameter, and shall indicate red when energized by abort command circuitry. The legend on the "Abort" light shall appear dull white on a dark background when the light is de-energized. Warning telelight assemblies shall be rectangular in shape and shall consist of amber light assemblies, nomenclature caps and retention clips. These shall be identical to the telelight assemblies as specified in Paragraph 3.8.9.4 except for legends and color of lights. The following warning lights shall appear:

Cabin Pressure
O_2 Quantity
O_2 Emergency
O_2 Pressure
CO_2 Pressure
Excess Suit H_2O
Excess Cabin H_2O
Fuel Quantity
Retro Warn
Retro Reset
Standby D.C. Auto*
Standby A.C. Auto*

3.8.9.4.1 WARNING LIGHTS - (Continued)

As a warning light circuit becomes energized, a tone generator becomes energized resulting in a steady tone audible to the astronaut through his headrest. This tone shall remain audible until the astronaut takes action to move the corresponding toggle switch in an inboard direction to the "OFF" position. The switches normally shall be set in the "TONE" position in order to permit the tone generator to be automatically audible. After a tone has been discontinued, the astronaut shall be required to place the switch in the "TONE" position for reset in event another warning occurs in that particular circuit.

*These have no corresponding audio "TONE" signals.

3.8.9.5 Deleted

3.8.9.6 DEAD RECKONING EARTH PATH INDICATION - A dead reckoning earth path indicator in accordance with MAC Drawing No. 45-81722 shall be provided in the instrument panel as indicated in Figure 4, Page 25. This indicator shall be a spring-driven unit requiring no electrical power and shall display the earth path by use of a gimballed globe approximately 3.85 inches in diameter. The globe (earth) shall rotate in a manner such that the location of the capsule relative to ground position appears beneath an index point in the center of the display. Touchdown point shall be indicated by an arrow which shall point to a red index point located on the lower portion of the indicator. Control knobs shall be provided for alignment of the earth path to the view indicated on the periscope. Control knobs shall be provided for "orbit E.W.", "polar E.W.", "orbit time", "wind", and "inclination degrees". The "inclination degrees" knob shall include radially arranged numbers and shall be located adjacent to the earth position index. Latitude and longitude lines shall be spaced in 15 degree increments as required for map compatibility (see Paragraph 3.16.2.1). Indicator glass shall be of a nonreflective type. R-1

3.8.9.7 SWITCHES AND HANDLES - The following switches and handles with their respective nomenclatures and functions shall be located on the instrument panel, left-hand console and right-hand console, as indicated. This tabulation shall be exclusive of sequence system override controls and warning light "TONE-OFF" switches as specified in Paragraphs 3.8.9.4 and 3.8.9.4.1. R-2

NOMENCLATURE

Type	Actuation	Function	Location
Toggle Switch	Arm-Off	Squib	
Toggle Switch	Arm-Off	Auto Retro Jett (P-9)	
Toggle Switch	Norm-Fly-By-Wire Aux.-Damp	ASCS Mode Select (P-19)	
Toggle Switch	Auto-Rate Comd.	ASCS Mode Select (P-26)	
Toggle Switch	Gyro Norm. Gyro Cage - Free	ASCS Mode Select	
"T" Handle**	Pull to Dump - (Push to Close)	Decompress	Left-Hand Console

** These shall be positively retained in the normal position by wire retention clips.

3.8.9.7 SWITCHES AND HANDLES - (Continued)

NOMENCLATURE

Type	Actuation	Function	Location
"T" Handle**	Pull to Repress - (Push to Reset)	Repressurize	
"T" Handle	Pull Direct - Push Rate Comd.	Manual Fuel Control	
"T" Handle	Pull Off - Push On	ASCS Roll	
"T" Handle	Pull Off - Push On	ASCS Yaw	R-2
"T" Handle	Pull Off - Pitch On	ASCS Pitch	
Toggle Switch*	Grnd. Pwr. - Cap Pwr-Off	Retro Heat	Left-Hand Console
Toggle Switch*	Norm-Inst.	Retro Delay (P-23)	
Toggle Switch*	Both-Off - L. H. Only	Cabin Lights	
Toggle Switch*	On-Off	Hi-Pwr Telemetry (Low Frequency)	
Toggle Switch	Light Test	Light Test	
Toggle Switch	Auto-Man On	Rate Indicator	
Push Button	Press	Time Zero (P-24)	
Toggle Switch	ASCS Only - Auto-Fans Only	Standby Inverter (P-18)	

* All toggle switches except these shall be channel guarded.

** These shall be positively retained in the normal position by wire retention clips.

3.8.9.7 SWITCHES AND HANDLES - (Continued)

NOMENCLATURE

Type	Actuation	Function	Location
Toggle Switch	Emerg-Norm	Audio Bus	Main Instrument Panel R-
Toggle Switch	Bypass-Norm - Pwr. Off	Ammeter	
Toggle Switch	ASCS-Fans	A.C. Volts	
Toggle Switch	No. 2 - Norm - No. 1	Suit Fan	
Toggle Switch	Off-Norm	Cabin Fan	
Toggle Switch	Man-Auto	Standby Battery	
Toggle Switch	Standby-Norm	Isolated Battery	
Toggle Switch	ASCS Off-Norm	Electric Power	
Toggle Switch	Dim-Bright	Warning Lights	
Toggle Switch	R/T-Norm	UHF DF (P-21)	
Toggle Switch	Lo Pwr-Hi Pwr	UHF Select (P-22)	
Toggle Switch	HF-UHF-Off	Transmit	
Toggle Switch	Grnd Comd - Cont.	Beacon	
Handle	Emerg.-Norm	Emergency O_2	Right Hand Console
Knob	Cooler (Rotate Counterclockwise)	Suit Temperature	
Knob	Cooler (Rotate Counterclockwise)	Cabin Temperature	

3.8.9.8 SWITCH FUSES - Switch fuses shall be provided for manual reset of interrupted circuits, but actuation by the astronaut shall be based upon his knowledge of the capsule systems and their functions. No special visual systems for indication of an interrupted circuit shall be provided. Switch fuses shall be located on the main instrument panel and on a switch fuse panel located to the astronaut's left adjacent to the outer panel of the left-hand console.

The following switch fuses shall be located on the extreme right of the main instrument panel:

Suit Fan	Envir. Cont'l
Retro Jett	Retro Man
Programmer	Spare

The following switch fuses shall be located on the switch fuse panel as follows:

Low Watt Telemetry Trans.

ASCS .05g

Emergency .05g

Emergency Posigrade Rocket

Emergency Tower Escape Rocket

Emergency Tower Sep. Cont.

Emergency Tower Jett Rocket

Emergency Tower Sep. Bolts

Reserve Deploy - Sys. B

Emergency Main - Sep. B

Emergency Drogue Deploy

Emergency Retro-Rocket Assy. Jett.

Emergency RR Man. Control

3.8.9.8 SWITCH FUSES - (Continued)

Emergency No. 1 RR Fire

Emergency No. 2 RR Fire

Emergency No. 3 RR Fire

Reserve Deploy - System A

Emergency Main - System A

Periscope Control

Antenna Switch

2.6.3.5.1 3.8.10 LIGHTING - Lighting for the cabin instruments and cameras shall be a dual A.C. system utilizing floodlights located in the pressurized area to the right and left of the astronaut. The lights, in accordance with MAC Drawing No. 45-79738, shall consist of two white, six inch flourescent tubes, each providing 4 watts illumination. Variation in light intensity shall be provided by use of dimmer slides mounted on each light assembly. The slides shall be designed to the curvature of the lights and shall contain tabs to permit actuation by the astronaut. The slides shall be maintained in any position by friction and shall be operable through any selected light intensity from bright to full dark. For night-day adaptibility, each light assembly shall have a red filter slide mounted in the inner track of the slide assemblies. The filter slides shall contain tabs to permit actuation by the astronaut and shall be operable either with or independent of the dimmer slides. The filter shall be positioned either in the full on or full off position and shall remain positioned by friction. R-2

3.9 CAPSULE ENVIRONMENTAL CONTROL

2.5.1.1.1 3.9.1 ENVIRONMENTAL CONTROL SYSTEM - Capsule environmental control shall be provided by the environmental control system in accordance with MAC Drawing No. 45-83700. The environmental control system shall provide the following:

a. Environmental control, internal circuit

b. Environmental control, cabin and equipment R-1

c. Deleted

d. Cabin pressure relief

e. Valve, post landing outflow

f. Deleted

g. Cooling, pre-launch

2.1.1.1 3.9.1.1 DESCRIPTION - The environmental control system shall consist of
2.5.1.1.2 a gaseous oxygen supply that shall furnish breathing, ventilation,
2.5.1.1.3 and pressurization gas for the cabin and internal circuit. The environmental
2.5.1.1.4 control system shall be designed to automatically control the environmental
2.5.1.1.7 conditions within the cabin and pressure suit (internal circuit) during all
2.5.1.2.1 phases of the mission as described in Paragraph 1.1.1 herein. Separate
2.5.1.2.5 evaporative heat exchangers shall cool the suit circuit and cabin. Oxygen flowing from the internal circuit compressor shall pass through the CO_2 and odor absorber, where the CO_2 shall be removed from the internal circuit gas flow. The absorber shall be divided into individual sections that shall contain a supply of activated charcoal and lithium hydroxide (LiOH). The activated charcoal shall remove odor and the LiOH shall remove the CO_2 from the gas flow. Filters shall be incorporated in the absorber to filter any charcoal or LiOH dust from the gas flow. A CO_2 sensor shall transmit the amount of CO_2 in the suit circuit to the CO_2 indicator provided on the main instrument panel. Moisture condensed in the suit circuit heat exchanger shall be absorbed and retained by a vinyl sponge. At timed intervals, the sponge automatically shall be compressed to force the condensate from the sponge to a condensate tank for storage. The sponge shall be compressed by a piston actuated by O_2 pressure. During the re-entry trajectory, at 20,000 feet, ambient air shall be directed into the cabin for cooling and ventilation. The equipment shall be as simple and passive in operation as practicable and shall provide the following:

3.9.1.1 DESCRIPTION - (Continued)

a. Metabolic oxygen, pressurization and ventilation in the pressure suit and cabin for twenty-eight (28) hours.

b. Pressure suit ventilation for twelve (12) hours of the post landing phase.

c. A selectable cabin temperature between 50 degrees F. and 80 degrees F. during orbit.

d. Comfortable humidity-temperature combinations within the pressure suit during all phases of flight. R-1

e. Carbon dioxide, moisture, odor and solid particles removal.

f. Suit and cabin pressure regulation during all phases of flight.

g. A decompression feature for fire extinguishing.

h. Satisfactory operation in a weightless or high "g" environment.

i. An emergency oxygen supply.

3.9.1.2 OPERATIONAL SEQUENCE

3.9.1.2.1 PRE-LAUNCH - During the capsule pre-launch operation, the suit circuit (with face piece closed) shall be purged by an external O_2 supply. During equipment checkout, cooling shall be provided from an external source through the open entrance hatch. After hatch closure, Freon 114 refrigerant shall be introduced into the cabin and internal circuit heat exchangers through the capsule umbilical to provide cooling for the astronaut and cabin. A leakage check of the hatch seal shall be made by pressurizing the cabin to 19.7 psia via an external source through the pressurization valve located in the hatch. Breathing gas from the internal O_2 supply shall be used by the astronaut during the countdown period. R-1

3.9.1.2.2 LAUNCH - During the launching phase, the cabin pressure shall equal atmospheric pressure to an altitude of approximately 27,000 feet and shall be maintained at approximately 5 psia thereafter. R-1

2.5.1.1.6
2.5.1.1.10

3.9.1.2.3 ORBITAL - The internal cabin temperatures during the orbital phase shall be dependent on the following:

a. Direct solar radiation absorbed at the outer surface of the vehicle.

b. Solar radiation reflected from the earth to the vehicle. R-1

c. Direct radiation emitted from the earth to the vehicle.

d. Radiation emitted from the vehicle to the earth and space.

e. Internal heat generation from astronaut and equipment.

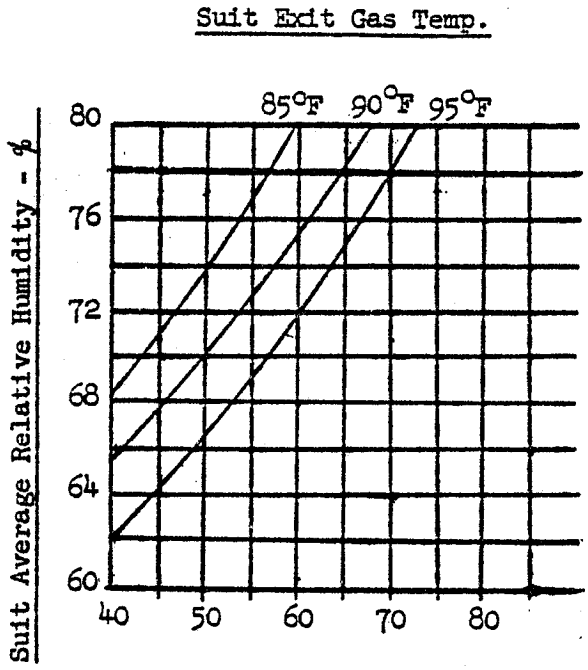
f. Mass of the structure, insulation, equipment and furnishings.

Cabin temperature can be regulated by adjustment of the cabin temperature valve. Cabin air shall be circulated by the cabin equipment blower, which shall force the cabin gas through the equipment heat exchanger and around the electronic equipment. The gas shall discharge from the electronic equipment and circulate within the cabin. Pressurization of the cabin shall be achieved by O_2 flow through the dual cabin pressure control valve. Pressure relief shall be afforded by the cabin pressure relief and emergency decompression valve.

O_2 shall be admitted from the normal O_2 bottle through pressure reducing valves which shall drop the pressure from 7500 psig to 100 psig. The suit pressure regulator shall supply O_2 necessary to maintain approximately a 5 psia level during the orbital period. During ascent and descent, the suit pressure regulator shall also equalize suit internal and external pressure. A separate emergency bottle in parallel with the normal bottle shall admit O_2 to the system through an O_2 pressure reducer which shall drop the pressure from 7500 psig to 80 psig. The cabin and internal suit circuits shall constitute redundant breathing and pressure sources, permitting the face piece to be open or closed as desired by the astronaut. R-

The internal suit circuit blower shall force gas through the pressure suit, solids trap, CO_2 and odor absorber, heat exchanger and water absorber. Pressure within the suit shall be maintained at 5 psia. The temperature and average humidity in the suit through the orbit phase shall be selected in the range shown below: R-2

3.9.1.2.3 ORBITAL - (Continued)



In the event of failure of the main suit compressor, a back-up compressor shall be actuated automatically by the blower pressure differential sensor. Should both fans fail, the astronaut may breathe cabin atmosphere or utilize the emergency oxygen system. In event of a meteoric collision causing depressurization of the cabin, the astronaut shall be able to continue by using the internal suit circuit for the full mission time at the normal oxygen usage rate or the emergency flow rate at approximately 0.05 lbs./min. In event of fire or build-up of toxic contaminants, the cabin may be decompressed. R-2

2.5.1.1.10 3.9.1.2.4 RE-ENTRY - During re-entry, the environmental control system shall function as in the orbital sequence. Prior to re-entry initiation, cabin and cabin contents shall be cooled to as low a value as possible. Suit and cabin pressures shall remain at approximately 5 psia until an altitude of 27,000 feet is reached. At 20,000 feet, external air shall be automatically circulated through the internal circuit. In an emergency, a re-entry following a double failure of the recirculation system, with or without cabin depressurization, shall be accomplished using the emergency oxygen

3.9.1.2.4 RE-ENTRY - (Continued)

rate to provide breathing, ventilation and pressurization of the internal suit. A reflective coating on the outer surface of the pressure suit will reduce radiant heat input.

2.5.1.2.5 3.9.1.2.5 POST LANDING PHASE - Operational provisions shall be incorporated in the internal circuit for a 12 hour post orbital period. Ambient air shall be drawn into the internal circuit through a snorkel fitting, circulated and exhausted overboard through a snorkel outlet.

2.5.1.1.5
2.5.1.1.10
2.5.1.2.4
3.9.1.3 OPERATIONAL MODES - The environmental control system shall operate automatically or manually in the following modes:

a. CABIN MODE - In this mode of operation the astronaut may have his suit face plate open to the cabin environment. The cabin temperature shall be selected by the astronaut, by actuation of the knob located on the right-hand console (see Paragraph 3.8.9.7). R-

b. SUIT MODE - In this mode the astronaut will have his suit face plate closed and the cabin atmosphere will be excluded. The CO_2 content of the suit gas supply shall be maintained below 8 mm Hg. Comfortable combinations of temperature and humidity shall be selectable. Dual blowers shall be provided in the suit circuit, and the standby blower shall be automatically switched in if the primary blower fails. The astronaut also shall be able to switch in the standby blower. (See Paragraph 3.8.9.7.) If the suit circuit fails, the emergency mode can be used. If the cabin system is operating normally when the suit circuit fails, the astronaut may open the face plate instead of actuating the emergency mode. R-

c. EMERGENCY MODE - In this mode of operation an automatic and/or manual emergency oxygen rate capability shall be provided. The emergency oxygen rate may be used during loss of cabin pressurization or during failure of the closed environmental control system. This oxygen shall be available for use in the suit mode (b) described above. This system shall be used through the suit by a direct open oxygen system in which expired oxygen is wasted by being dumped into the cabin and then overboard. Provision shall be made to permit the use of remaining normal cabin oxygen supply for this mode; however, special provision shall be made to prevent loss of oxygen to the cabin system if the cabin system fails. R-

3.9.1.4 ENVIRONMENTAL CONTROL SYSTEM WARNING INDICATION - Amber warning lights (with accompanying audio tones) shall be provided on the warning light portion of the main instrument panel (see Paragraph 3.8.9.4.1) for indication of the following: R-1

Cabin Pressure (Loss of cabin pressure below 4 psi)

O_2 Quantity (Low O_2 quantity)

O_2 Emergency (Emergency O_2 flow)

O_2 Pressure (Loss of O_2 pressure - less than 200 psi remaining in normal bottle)

CO_2 Pressure (CO_2 warning)

Excess Suit H_2O

Excess Cabin H_2O

2.3.1.1 3.10 STABILIZATION CONTROL SUBSYSTEM - The stabilization control subsystem shall consist of the automatic stabilization and control system, the rate stabilization and control system, the horizon scanners and the reaction control system. The launch trajectory control and guidance shall be considered an integral part of the launching missile system and shall not be the responsibility of the capsule contractor. R-1

2.3.1 2.3.2.1.5 2.3.2.1.3 3.10.1 AUTOMATIC STABILIZATION AND CONTROL SYSTEM - The automatic stabilization and control system (ASCS) as defined in McDonnell Drawing No. 45-87700 shall provide automatic stabilization and orientation of the capsule from time of separation from the booster-adapter until landing parachute deployment in accordance with the various phases of the mission. The ASCS shall supply output signals for display, recording and telemetering of three axis attitude information, a discrete signal at 0.05g longitudinal acceleration during re-entry, and an attitude signal sector for use in the capsule retrograde firing interlock circuit. Associated equipment consisting of the horizon scanners, reaction controls, communications system telemetry, devices for display of the capsule attitude, and devices for generating capsule signals for discrete mission events, shall be utilized by the ASCS. The expenditure of propellant in limit cycle oscillations shall be minimized by the design of the control system.

2.3.1 2.3.1.3 3.10.1.1 MODES OF OPERATION - The ASCS shall have four modes of automatic operation. These shall be damper mode, orientation mode, attitude-hold mode and re-entry mode. In addition, the ASCS shall include switching to allow alternate manual fly-by-wire and auxiliary damping modes. In the fly-by-wire mode, in which rate damping circuitry shall be energized, the automatic reaction control nozzles shall be controllable by the astronaut through stick position potentiometers actuated by stick controller motion. The auxiliary damping mode shall provide rate damping only and shall disengage the automatic and fly-by-wire functions. Other than override controls, no provisions shall be made for manual stepping of the ASCS automatic sequencing. R-1

2.3.1.2 2.3.1.3 2.3.1.4 2.3.2.1.1 3.10.1.2 SEQUENCE OF OPERATION - The following general sequence of operation shall be provided by the ASCS.

a. Rate damper operation in early abort cases.

b. Rate damping and orientation to desired attitude in later aborts or in normal missions.

c. Orientation during orbital flight with respect to the local earth vertical (such that the astronaut's head is up). R-1

d. Capsule alignment to specified pitch angle (-24 degrees to -60 degrees blunt end up) just prior to retrograde rocket firing.

e. Capsule orientation hold during retrograde rocket firing.

3.10.1.2 SEQUENCE OF OPERATION - (Continued)

f. Capsule reorientation to selected re-entry attitude following retrograde rocket firing.

g. Switching to rate damper mode at longitudinal acceleration (from drag buildup) of 0.05g and providing a steady roll of approximately 10-12 degrees per second thereafter until disengagement.

h. Disengagement when landing chute deploys.

The ASCS shall include pitch, roll and yaw rate gyros, an attitude reference system and a longitudinal accelerometer. The rate gyros shall sense capsule rotational rates, and the longitudinal accelerometer shall sense 0.05g longitudinal acceleration for initiation of the re-entry mode. The attitude reference system consisting of a vertical and a directional gyro, which with signal inputs from the horizon scanners, shall sense pitch, roll and yaw attitudes. The pitch and roll outputs of the horizon scanners shall be utilized to precess the gyros such that their spin axes shall be maintained in the properly erected position relative to the moving local vertical axis. Prior to launch, both the vertical and directional gyros shall be torqued so as to erect their spin axes to any desired orientation relative to the launch trajectory. During the climb phase of the mission to tower separation, the vertical gyro spin axis shall be erected to the horizon scanners. While in the final phase of the climb to capsule-adapter separation, and for a period of five (5) minutes following, both the vertical and directional (roll gimbal only) gyros shall be slaved to the horizon scanners. During the orbital phase of the mission, both gyros shall be slaved to the horizon scanners during their intermittent operation as generated by signals from the data programmer. For ten (10) minutes prior to time of retrograde firing, both gyros shall be continuously slaved to the horizon scanners. At time of retrograde firing, the gyros shall not be slaved to the scanners which shall be in a period of non-operation. Upon retrograde assembly jettison until capsule deceleration to 0.05g, the gyros shall again be slaved to the horizon scanners. At 0.05g, the gyros and horizon scanners shall be de-energized and the capsule pitch and yaw angular rates shall be reduced to a value of 0.8 degrees per second or less, while a steady state roll rate of 10 to 12 degrees per second shall be maintained until disengagement of the ASCS at main landing parachute deployment altitude of 10,000 feet. R-1

3.10.1.3 RATE STABILIZATION AND CONTROL SYSTEM - A rate stabilization and control system shall be provided. This system, which shall operate independently of the ASCS, shall provide a redundant rate damping feature that shall act as an aerodynamic control response system, providing the astronaut with a control stick steering mode. Movement of the three-axis hand controller shall provide capsule angular rates approximately proportional and corresponding to stick deflection. The rate stabilization and control system shall include a rate damper, three control stick position potentiometers, addition of six solenoid control valves and a fuel selector valve to the manual reaction control subsystem, attitude indicating system pitch, roll and yaw rate transducers, plus necessary mode select switch, connectors and wiring. Use of the rate stabilization and control system in event of ASCS malfunction following retrograde rocket firing shall require a constant roll rate capability. An automatic constant seven (7) degree roll rate shall be initiated by closure of the ASCS 0.05g acceleration switch. This shall provide stabilization during the re-entry trajectory without requiring hand controller manipulation by the astronaut.

3.10.1.3.1 OPERATION - The rate stabilization and control system shall be activated by the astronaut by selection of the "rate command" position of the "Auto-Rate" command mode select switch and by depression of the manual fuel control handle to permit H_2O_2 fuel flow from the fuel selector valve to the solenoid valves. Upon selection of the "rate command" mode, power shall be applied to the rate damper electronics. The rate damper shall receive rate error information from the rate transducers and rate command signals from the control stick potentiometers located on the hand controller linkage. These inputs shall be summed by the rate damper summing preamplifier-demodulator, where angular rates must exceed a deadband zone of plus or minus two (±2) degrees per second before an output signal shall be transmitted to torque switching logic relays. Upon receipt of a signal for corrective positive and negative commands, the appropriate logic relay shall energize the positive or negative solenoid valve and initiate corresponding thrust chamber reaction.

2.3.2.3
2.3.1.3

3.10.2 HORIZON SCANNER - A horizon scanner system in accordance with MAC Drawing No. 45-87702 shall be provided for sensing roll and pitch attitude reference for the ASCS. The horizon scanner system shall consist of two scanner units; one unit aligned to the capsule pitch axis and one unit aligned to the capsule roll axis. The scanners shall be body-mounted to structure within the antenna fairing assembly, and shall provide a 118 degree conical scan of the horizon through a rotating prism located ahead of the scanner lens. The prism shall rotate at a speed of approximately 30 revolutions per second. Each scanner unit shall receive A.C. power inputs through the capsule A.C. power system and shall supply D.C. output signals of the required polarity to provide roll and/or pitch signals up to a maximum R-2

3.10.2 HORIZON SCANNER - (Continued)

of 35 degrees for torquing the attitude gyros in the ASCS. Yaw sensing shall be achieved through torquing of vertical and directional gyros of the ASCS by horizon scanner roll signal inputs. Pitch and roll sensing shall possess sufficient accuracy to enable the astronaut to orient the capsule within ± 1 degree of the orbital attitude. The scanners shall be energized at time-zero and shall function as indicated on the sequential schematic, Figure 6, page 67.

2.3.2.2 3.10.3 REACTION CONTROL SYSTEM - The reaction control system in accordance with MAC Drawing No. 45-61700, shall consist of an automatic control subsystem and a manual control subsystem, as depicted in Figure 5, page 55 herein. The reaction control system shall provide control of the capsule in the roll, pitch and yaw axes. This system shall be a pressure-fed, monopropellant/catalyst bed design, incorporating right angle firing exhaust nozzles, which shall produce thrust through decomposition of hydrogen peroxide (H_2O_2). Minimal translational motions may result upon application of reaction control thrust. R-1

2.3.1.4 3.10.3.1 AUTOMATIC CONTROL SUBSYSTEM - The automatic control subsystem shall consist of a helium (He) sphere, pressure regulator, hydrogen peroxide (H_2O_2) propellant tank, and twelve (12) exhaust nozzle assemblies each consisting of a solenoid valves, heat barrier and thrust chamber, together with associated piping and fittings. This system shall function automatically in conjunction with signal inputs from the automatic stabilization and control system. The helium pressure transducer shall provide a means of monitoring (by proper calibration) the percentage of H_2O_2 present in the bladder. Sufficient H_2O_2 and He shall be provided to maintain damper operation until after main parachute deployment at which time the H_2O_2 shall be jettisoned. R-3

2.2.1.5 2.3.1.4 2.3.2.2 2.3.3.2 2.3.3.2.1 2.3.3.2.2 2.3.3.1 2.3.3.2 3.10.3.2 MANUAL CONTROL SUBSYSTEM - The manual control subsystem shall consist of a helium (He) sphere, pressure regulator, hydrogen peroxide (H_2O_2) propellant tank, manual proportional control valves, and six (6) exhaust nozzle assemblies, each consisting of a check valve, heat barrier and thrust chamber. The manual control subsystem shall include a two-way selector valve to provide selection of proportional torque control or rate command (via RSCS) through six (6) solenoid valves which shall receive positive and negative torque command signals from the RSCS rate damper. The manual subsystem shall be controlled by the astronaut by means of the 3 axis hand controller (See paragraph 3.8.8.2.1), and shall be capable of overcoming the disturbance torque resulting from firing the retrograde rockets. Sufficient H_2O_2 and He shall be provided to maintain damper operation until after main parachute deployment at 10,000 feet geometric altitude at which time the H_2O_2 shall be jettisoned. R-2

2.3.2.2.1
2.3.2.2.2
2.3.2.2.3
2.3.2.2.4
2.3.2.2.5
2.3.1.3

3.10.3.3 OPERATION - High pressure helium (He) shall be utilized to pressure the H_2O_2 torus propellant tanks. The high pressure (3000 psig) helium gas shall pass through a filter and manual shutoff valve to a pressure regulator which shall reduce the pressure to 450 psig, check valve, and finally, to surround and pressure the flexible bladder of the torus tank. The helium pressure shall force the H_2O_2 out of the bladder through the perforated tube downstream into the lines and valves. The manual push-pull shutoff valves, which allow the H_2O_2 to be available at the solenoid valves, shall provide a means of individual system isolation and shutoff. Upon receiving a 24 volt D.C. signal from the ASCS, the appropriate solenoid valve shall open. H_2O_2 shall then pass into the corresponding thrust chamber where it shall be decomposed providing the following thrust levels for operation with the ASCS: R-1

a. High thrust level of twenty-four (24) pounds for pitch and yaw axes and six (6) pounds for the roll axis.

b. Low thrust level of one (1) pound for all three axes.

These thrust levels shall be available in discrete, short-time periods as controlled by the ASCS.

The helium pressure transducer shall provide a means of monitoring the percentage of H_2O_2 present in the bladder. The internal transfer tube shall guarantee uninterrupted and total fuel flow. The external transfer tube shall assure that no helium shall be trapped during propellant filling. R-1

The manual control subsystem shall provide proportional control or rate command (via RSCS) thrust levels between four (4) and twenty-four (24) pounds for pitch and yaw axes and between one (1) and six (6) pounds for roll axis. Those thrust outputs shall be controlled from the hand controller either through direct stick control or through the rate stabilization and control system electronics.

3.10.3.4 TANKS - The helium tanks for the reaction control system shall be located in the cabin and shall be of spherical fiberglass construction. These tanks shall store the He at 3000 psi and shall pressure feed to the H_2O_2 tanks at 460 psi. The H_2O_2 tanks shall be of a half-toroidal configuration contoured to mount on the large pressure bulkhead in the cavity between the bulkhead and the heat shield. The H_2O_2 tanks shall be of aluminum construction insulated to provide temperature control. The H_2O_2 tanks shall incorporate a flexible plastic bladder to provide for positive expulsion of the H_2O_2. Provisions for in-flight jettison of H_2O_2 following main chute deployment shall be provided. R-1

REACTION CONTROL SYSTEM

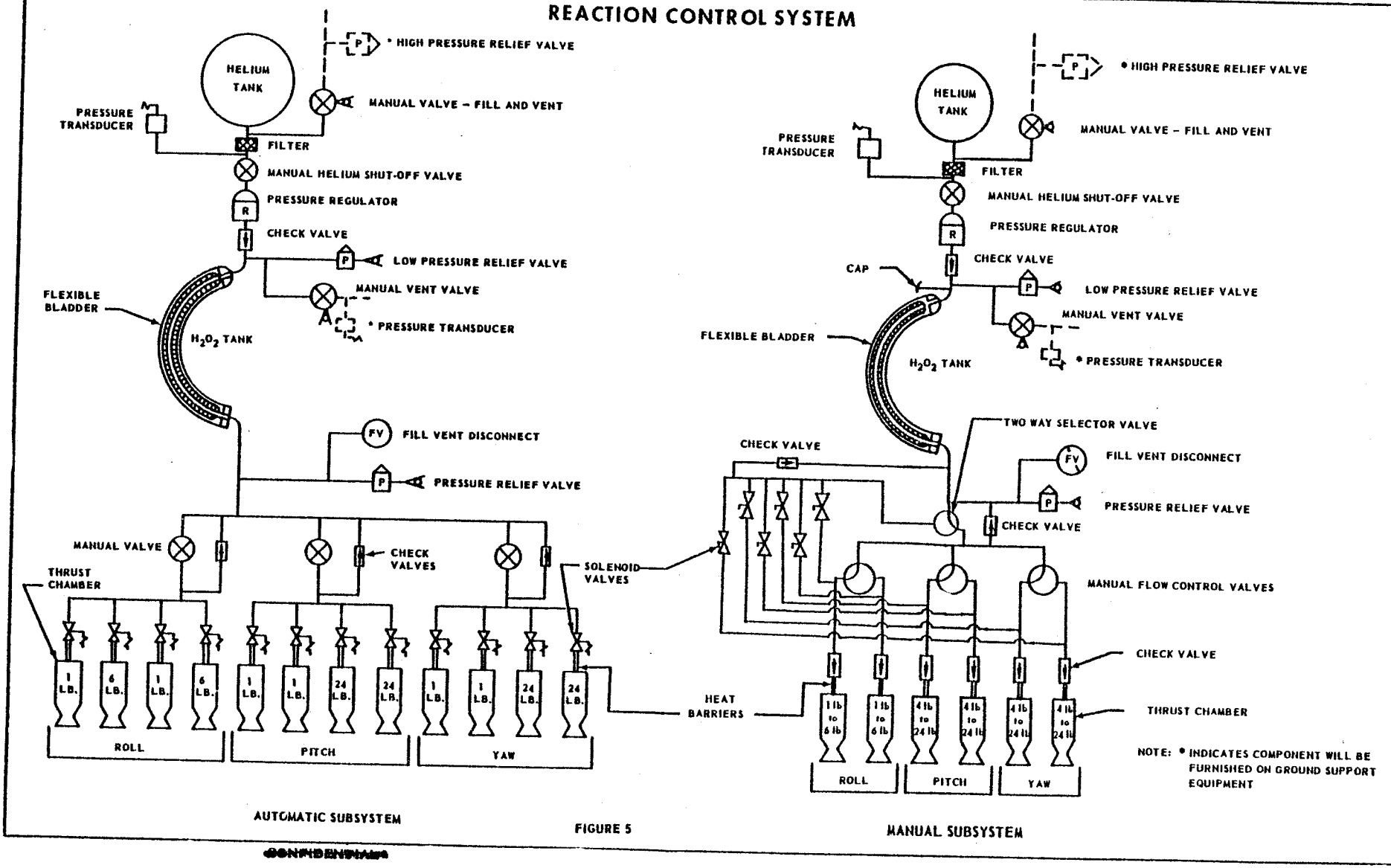


FIGURE 5

CONFIDENTIAL

3.11 RETROGRADE ROCKET SYSTEM -

2.3.4.1 2.3.4.2.1 3.11.1 DESCRIPTION - Re-entry into the earth's atmosphere shall be initiated by firing of a retrograde rocket system provided in accordance with MAC Drawing No. 45-50001 and consisting of three (3) Thiokel Model TE-316 solid propellant rockets and associated components as specified in Appendix I-C herein. The target value for magnitude of the retro-impulse shall be to provide a velocity decrement of approximately 500 feet per second for the capsule weight as specified in paragraph 3.1.1.2. The retrograde rockets in accordance with MAC Drawing No. 45-50700 shall have a total vacuum impulse of approximately 13,000 pound-seconds providing an average thrust of 992 pounds each for an action time of 13.2 seconds under the conditions specified in MAC Drawing No. 45-50700. R-2

2.3.4.1.2 2.3.4.2.2 3.11.2 INSTALLATION - The retrograde rocket assembly shall be mounted in a structural assembly in accordance with MAC Drawing No. 45-50002. This shall consist of a structural frame assebly encased within an insulated aluminum housing which shall be secured external to the ablation shield by retaining straps. The retaining straps, in accordance with MAC Drawing No. 45-72030, shall be attached to the capsule by retention fittings in accordance with MAC Drawing No. 45-32086, which shall remain engaged only so long as tension exists in the straps and to the rocket structural assembly by a centrally located explosive bolt in accordance with MAC Drawing No. 45-72704. For capsule shipment, an inert explosive bolt shall be provided, but prior to capsule launching, a "live" explosive bolt shall be installed. Jettison of the retrograde rocket assembly shall be effected by release of the retaining straps by firing the explosive ejector bolt, removing tension from the retaining straps, and permitting a compression spring jettison assembly, in accordance with MAC Drawing No. 45-50013, to thrust the retrograde assembly from the capsule. Initiation of the ejector bolt shall be through a firing command latching signal which shall permit retrograde assembly jettison after run-out of a 60 second time delay relay even though one or none of the rockets has fired. The rockets and rocket nozzles shall be shielded by cover assemblies in accordance with MAC Drawing No. 45-50012 for protection against meteorite penetration. The covers shall blow off as the rocket fire. The rocket assembly housing shall be finished with a paint possessing sufficient solar absorptivity characteristics to provide a relatively warm environment within the enclosure. Provisions shall be made within the housing to insure proper temperature control by inclusion of a heater assembly in accordance with MAC Drawing No. 45-50702 and thermostat assembly in accordance with MAC Drawing No. 45-79705 in each rocket installation as well as Thermoflex insulation. Rocket thrust direction shall be aligned on the ground prior to launch so as to minimize eccentricity between the thrust vector and the capsule center of gravity. R-1

3.11.3 IGNITION - Automatic sequencing of the retrograde operation may be initiated by a signal from any one of three sources; signal from the satellite clock, a ground command signal via the command receivers and decoders (see paragraph 3.14.2); or, manually by astronaut override by actuation of the push button (P-6) adjacent to the "Retro Seq." telelight. Normally, the initiating signal from the satellite clock shall transmit a signal to the re-entry mode of telemetry and instrumentation while simultaneously transmitting a signal to the ASCS to command the retrograde attitude of -34 degrees and to energize a 30 second time delay relay. A signal shall be transmitted to an "attitude permission" switch in the ASCS, which will complete a circuit the 30 second time delay relay. If the retrograde attitude of -34 degrees is correct, upon run-out of the 30 second time delay relay, a signal shall be transmitted to the retrograde rocket firing circuits to sequentially fire the rockets at 5 second intervals. The firing command shall energize an integrating accelerometer which shall in turn energize a 4 minute and an 8 minute time delay relay. The integrating accelerometer shall initiate telemetry, on-board recording, and telelight indication of retrograde rocket firing and provide measurement of velocity decrement as a result of rocket firing. The velocity decrement sensed after run-out of the 4 minute time delay and the 8 minute time delay shall be transmitted to the ground via telemetry for indication of time of retrograde rocket firing. Determination of firing time can be made by subtraction of 4 or 8 minutes from the time of ground signal receipt. At the same time as the rocket firing signal is initiated, the ASCS "attitude permission" switch shall energize a 30 second time delay relay, which upon run-out, shall apply a "retrograde fire" signal to the ASCS. Jettison of the retrograde assembly shall be as described in Paragraph 3.11.2. R-2

3.11.4 POSIGRADE ROCKET SYSTEM - Separation of the capsule from the adapter-booster vehicle shall be aided by firing of a posigrade rocket system provided in accordance with MAC Drawing No. 45-50001 and consisting of three (3) Atlantic Research Corporation solid propellant rockets as specified in Appendix I-C herein. These rockets shall have a total vacuum impulse of 475 pound-seconds each providing an average thrust of 370 pounds each for an action time of 1.35 seconds under the conditions specified in MAC Drawing No. 45-50701. Firing of the posigrade rockets shall produce a separate velocity of 28 feet per second. The posigrade rockets shall be symmetrically mounted in the retrograde rocket assembly housing between the retrograde rockets. Posigrade rocket system initiation shall be accomplished automatically through a separation signal from the capsule-adapter ring separation sensor after firing of the capsule-adapter clamp ring explosive bolts. Measurement of the velocity increase as a result of posigrade rocket action shall be sensed by the integrating accelerometer, which shall be energized by the capsule-adapter ring separation sensor. The integrating accelerometer shall initiate on-board recording and telemetry and shall transmit to the ground the velocity increase and "pop-gun" effect resultant from firing of the posigrade rockets. The integrating accelerometer shall cease integrating upon signal from a 5 second time delay relay after capsule-adapter separation. (See Figure 6, page 67.) R-1

3.12 ESCAPE SYSTEM - An active escape system shall be provided as an integral part of the capsule. The escape system shall provide positive capsule-sustainer separation characteristics and adequate launch aerodynamic heating protection for the capsule afterbody. This system shall be capable of functioning during various periods up to tower separation should it become necessary to abort a mission and escape from the vicinity of the Atlas missile system. Escape sequence prior to and after release of the active escape system for either normal or aborted mission shall be as specified in Paragraph 3.12.5.

3.12.1 DESCRIPTION - The escape system shall include a pylon framework assembly in accordance with MAC Drawing No. 45-31001, which shall support an escape rocket installation in accordance with MAC Drawing No. 45-51001. The escape rocket installation shall consist of a structural assembly in accordance with MAC Drawing No. 45-51002, an escape rocket in accordance with MAC Drawing No. 45-51700, a pylon jettison rocket in accordance with MAC Drawing No. 45-51701, and an aerodynamic spike in accordance with MAC Drawing No. 45-51010, and ballast assembly in accordance with MAC Drawing No. 45-51017. The pylon assembly shall be a tower structure consisting of three (3) longitudinal members of tubular steel construction diagonally braced and attached to the capsule cylindrical recovery compartment by a clamp ring assembly. A 45° aerodynamic fairing shall be installed over the pylon clamp ring to reduce the pylon ballast weight and to facilitate greater aerodynamic stability of the capsule up to tower separation. The clamp ring assembly, in accordance with MAC Drawing No. 45-72040, shall consist of three (3) segmented sections each joined by explosive bolts in accordance with MAC Drawing No. 45-72702. Two of the explosive bolts shall be initiated electrically from either end by a dual electrical system and the third bolt shall be electrically initiated from one end and by a gas generated source on the other end through a percussion system. Initiation of the clamp ring separation explosive bolts shall be as described in Paragraph 3.12.5. R-1

3.12.2 ESCAPE ROCKET - The escape rocket, in accordance with MAC Drawing No. 45-51700, shall be supported by the pylon structure and the aerodynamic spike and ballast assembly shall be secured to the escape rocket structural assembly. The escape rocket shall consist of a solid propellant rocket motor with three (3) nozzles canted nineteen (19) degrees from the longitudinal axis of the rocket case and an electrically actuated igniter. The nominal action time for the escape rocket shall be 1.39 seconds with an average resultant thrust of 52,000 pounds at its center line. Nominal thrust impulse rating of this rocket shall be 56,500 pound-seconds, under conditions specified in MAC Drawing No. 45-51700.

3.12.3 PYLON JETTISON ROCKET - The pylon jettison rocket in accordance with MAC Drawing No. 45-51701, shall be supported by the escape rocket structural assembly. This rocket shall be mounted on the escape rocket longitudinal axis among the canted nozzles. The pylon jettison rocket shall consist of a solid propellant rocket motor, and electrically actuated igniter. The nominal action time for this rocket shall be 1.6 seconds with a maximum resultant vacuum thrust of 765 pounds and total impulse of 1145 pound-seconds, under conditions specified in MAC Drawing No. 45-51701.

3.12.4 ESCAPE SYSTEM PERFORMANCE - The escape system during an escape from the ground launching pad shall propel the capsule to an altitude of approximately 2200 feet. Determination of the nominal escape rocket thrust eccentricity shall be the result of rational analysis which will attain a reasonable compromise between adequate capsule-booster separation distance and tolerable astronaut and structural lateral load factor characteristics. The analysis shall consider effects such as: R-1

a. Capsule abort conditions as a result of booster malfunction.

b. Booster flight characteristics subsequent to capsule-adapter separation.

c. Capsule escape rocket thrust eccentricity tolerance

The determination of booster flight conditions leading to the initiation of the abort maneuver and following capsule separation shall not be the responsibility of the capsule contractor.

2.1.4

3.12.5.1 NORMAL MISSION - Normal sequence for the mission defined in Paragraph 1.1.1 shall be as defined below. (See the Sequential Schematic, Figure 6, Page 67.)

A. At booster lift-off (8 inches off the pad) the following shall occur:

1. The booster failure detection system shall be activated.

2. A time zero reference established in the satellite clock.

3. A time zero reference established in the maximum altitude sensor and recording equipment.

B. At booster engine cut-off, the following shall occur:

1. An accelerometer type thrust cut-off sensor shall sense booster engine thrust decay to 3.0g and shall upon receiving a booster engine separation signal energize a twenty (20) second time delay relay. R-1

2. Upon run-out of the twenty (20) second time delay, the pylon clamp ring explosive bolts shall be initiated by closure of the "normal" contacts in a power and control relay.

3. Initiation of the explosive bolts shall permit separation of the clamp ring segments.

4. Separation of the clamp ring segments shall actuate a limit switch sensor which shall transmit a firing signal to the escape rocket and energize a power and control relay, which shall transmit a signal to the thrust cut-off sensor 0.20g comparator.

5. Firing of the escape rocket shall actuate the tower separation limit switch sensor from the "not separated" position. Firing of the escape rocket shall carry the tower from the path of the capsule and sustainer portion of the missile as they ascend in their trajectories to orbital insertion.

6. The tower separation sensor shall arm the landing sequence system.

3.12.5.1 NORMAL MISSION - (Continued)

C. At sustainer cut-off the following shall occur:

1. An accelerometer type thrust cut-off sensor shall sense sustainer thrust decay to 0.20g at which condition the thrust cut-off sensor shall transmit a firing signal to the capsule-adapter clamp ring explosive bolts. Initiation of the explosive bolts shall permit separation of the capsule-adapter clamp ring.

D. At capsule-adapter clamp ring separation, the following shall occur:

1. The adapter ring limit switch sensor shall be activated from the "not separated" to the "separated" position and shall transmit a signal to the "separation" contacts of a power and control relay and start the integrating accelerometer for sensing of velocity increase as a result of posigrade rocket firing.

2. The power and control relay shall transmit a firing signal to the posigrade rockets.

3. Firing of the posigrade rockets shall actuate the capsule-adapter separation limit switch sensor "separation" contacts.

4. The capsule-adapter separation sensor shall arm the satellite clock, energize the HF communications, and transmit a signal to a power and control relay, which will close to the "separation" position if tower separation has occurred. The power and control relay shall transmit a separation signal to the tower separation abort interlock relay, which shall result in closure of the "normal" contacts of this relay.

5. The tower separation abort interlock relay shall simultaneously energize the following:

a. A 5 second time delay relay, which shall stop integration of the integrating accelerometer.

3.12.5.1 NORMAL MISSION - (Continued)

b. A power and control relay which shall command the damping mode of the ASCS until run-out of the 5 second time delay relay at which time the orbit orientation mode shall be commanded.

c. A power and control relay which shall be held in the open position for 20 seconds by a time delay relay if the tower has separated. Upon run-out of the 20 second time delay, the relay shall close, energizing another power and control relay which shall automatically extend the periscope.

d. A power and control relay which when the "normal" contacts are closed shall energize a 5 minute time delay relay and a relay which shall command the retro attitude mode of the ASCS until run-out of the 5 minute time delay relay at which time the orbit orientation mode shall again be commanded and the orbit mode of the telemetry and instrumentation shall be activated.

E. At retrograde time-to-go, the following shall occur:

1. The satellite clock shall command the ASCS to assume the retrograde attitude.

2. The satellite clock shall energize a 30 second time delay relay and a 30-second by-pass switch in event that it may be necessary for the astronaut to override the 30 second time delay relay.

3. The satellite clock shall initiate the telemetry and instrumentation re-entry modes.

4. Upon run-out of the 30 second time delay relay, a signal shall be transmitted to the ASCS "attitude permission" switch to command an "attitude correct" signal from the ASCS for firing of the retrograde rockets.

3.12.5.1 NORMAL MISSION - (Continued)

5. At the same time as the retrograde firing signal is applied, the integrating accelerometer for sensing velocity decrement shall be activated and a 30 second time delay relay shall be energized and a retrograde fired signal applied to the ASCS for the 30 second period. The capsule shall be held in the retro-firing position of -34 degrees for 60 seconds by these two relays. Firing and jettison of the retrograde rocket assembly shall be as specified in Paragraphs 3.11.2 and 3.11.3.

F. At retrograde assembly jettison, the following shall occur:

1. The retrograde assembly separation limit switch sensor shall energized a 30 second time delay relay, which upon run-out shall retract the periscope.

2. The retrograde attitude mode of the ASCS shall be switched to a re-entry orientation mode for conditions below 0.05g. A 5 second time delay realy shall be energized, which upon run-out, shall arm the ASCS accelerometer for sensing capsule conditions greater than 0.05g for re-entry stabilization, until drogue chute deployment. Landing system sequence shall be as described in Paragraph 3.17.1.

2.1.4.1.7 3.12.5.2 ABORTED MISSIONS - Mission aborts may occur either prior to staging or after staging as defined in the following paragraphs. Abort indication shall be provided by a red "abort" light on the left-hand console (see Paragraph 3.8.9.4.1).

2.1.4.1.1 2.1.4.1.7 3.12.5.2.1 ABORT INITIATION - An abort shall be initiated by application of a 28 volt signal to the abort junction in the escape system electrical network. Upon receipt of a signal, the 28 volt source shall be instantly "locked in" at this junction and shall provide the necessary power source to initiate the abort sequence, consistent with the mode in which the abort maneuver is necessary. Mission aborts may be initiated under any of the following conditions:

a. Prior to capsule umbilical separation, an off-the-pad abort may be initiated from the blockhouse.

3.12.5.2.1 ABORT INITIATION - (Continued)

b. After capsule umbilical separation and prior to missile lift-off (8 inch altitude), an abort can be initiated by radio command and by hard line which by-passes the missile lock-out relay via the missile umbilical.

c. After missile lift-off, prior to missile umbilical separation, an abort can be initiated by radio command, by hard line via missile umbilical and by the missile abort sensing and implementation system (ASIS).

d. After missile umbilical separation and prior to booster and/or sustainer cut-off, an abort can be initiated by radio command, the missile abort sensing and implementation system (ASIS) or by the astronaut. (Ability of ASIS to shut down engines deactivated until T + 30.) R-1

e. After booster shut-down and tower jettison, but prior to sustainer cut-off, an abort can be initiated by radio command, the missile abort sensing and implementation system (ASIS) or by the astronaut.

f. After sustainer cut-off, an abort may be initiated by radio command or by the astronaut.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - Upon receipt of an abort command from sources a, b, c, or d as outlined in Paragraph 3.12.5.2.1, the following shall occur:

a. The capsule "ABORT" light shall be illuminated and the abort switches energized.

b. At T + 30, a shut-down command shall be transmitted to the booster (Stage 1) and sustainer (Stage 2) engine systems. R-1

c. A power and control relay shall transmit a firing signal to the capsule-adapter clamp ring explosive bolts. Initiation of the explosive bolts shall permit separation of the clamp ring segments. This shall be detected by the adapter ring separation sensor which shall transmit a firing signal to the escape rocket. Firing of the escape rocket shall propel the capsule from the path of the booster vehicle.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - (Continued)

d. Escape rocket firing shall be detected by the capsule adapter separation sensor relays which shall:

1. Energize HF communications.

2. Transmit an abort signal to a relay which shall energize the "not separated" contacts of a second relay. The second relay shall initiate firing of the retrograde assembly explosive ejector bolt for separation of the retrograde rocket assembly. The retrograde assembly separation sensor shall energize a 5 second time delay relay which shall arm the ASCS accelerometer switch for sensing capsule conditions greater than 0.05g.

3. Provide an interlock for the output of the maximum altitude sensor (time versus time computer). The maximum altitude sensor in accordance with MAC Drawing No. 45-87708 shall compute a time delay for abort tower separation versus real time beginning at time zero. This delay shall permit the capsule to reach a safe dynamic pressure before jettisoning the escape tower. The time delay (Δ T) for tower separation with relation to time of abort (T_A) after time zero, shall be as follows: R-1

$$\Delta T, \text{ Sec.} = 0.1855\ T_A + 7.0 \qquad 0 \leq T_A \leq 62.0$$

$$\Delta T, \text{ Sec.} = 1.6139\ T_A - 81.5630 \qquad 62 \leq T_A \leq 81.62$$

$$\Delta T, \text{ Sec.} = 50.165 \qquad T_A \geq 81.62$$

The maximum altitude sensor shall initiate firing of the pylon clamp ring explosive bolts, permitting separation of the clamp ring segments.

e. Simultaneous with the output to the maximum altitude sensor, the capsule-adapter separation sensor shall energize a power and control relay which shall close upon receipt of a tower separation signal and transmit an abort signal to the tower separation abort interlock relay which shall command the rate damping mode of the ASCS.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - (Continued)

f. The pylon clamp ring shall have separated, the tower ring separation sensor shall have energized a power and control relay, which upon receiving a signal from the tower abort interlock relay, shall initiate firing of the pylon jettison rocket. Firing of the pylon jettison rocket shall have actuated the tower separation sensor, which arms the landing sequence system (See Paragraph 3.17.1). R-1

3.12.5.4 ABORT SEQUENCE AFTER TOWER SEPARATION - Upon receipt of an abort command from sources e or f as outlined in Paragraph 3.12.5.2.1, the following shall occur:

a. The capsule "ABORT" light shall be illuminated and the abort switches energized.

b. The sustainer engine system (Stage 2) shall be shut down.

c. A power and control relay shall transmit a signal to a thrust cut-off sensor which shall sense sustainer engine thrust decay to 0.20g and initiate firing of the capsule-adapter clamp ring explosive bolts. Initiation of the explosive bolts shall permit separation of the clamp ring segments. This shall be detected by the adapter ring separation sensor which shall energize the integrating accelerometer for sensing velocity increase as a result of posigrade rocket firing and resultant "pop-gun" effect. The adapter ring separation sensor shall energize a power and control relay which, if tower separation has occurred, shall transmit a firing signal to the posigrade rockets. Firing of the posigrade rockets shall provide a velocity increase of 28 feet per second for separation of the capsule from the adapter-sustainer complex.

d. The capsule-adapter separation sensor shall arm the satellite clock, which shall receive a reset command from the ground or by the astronaut to initiate the normal retrograde sequence as defined in Paragraph 3.12.5.1, sub-paragraphs D4, D5, E, and F.

SEQUENTIAL SCHEMATIC

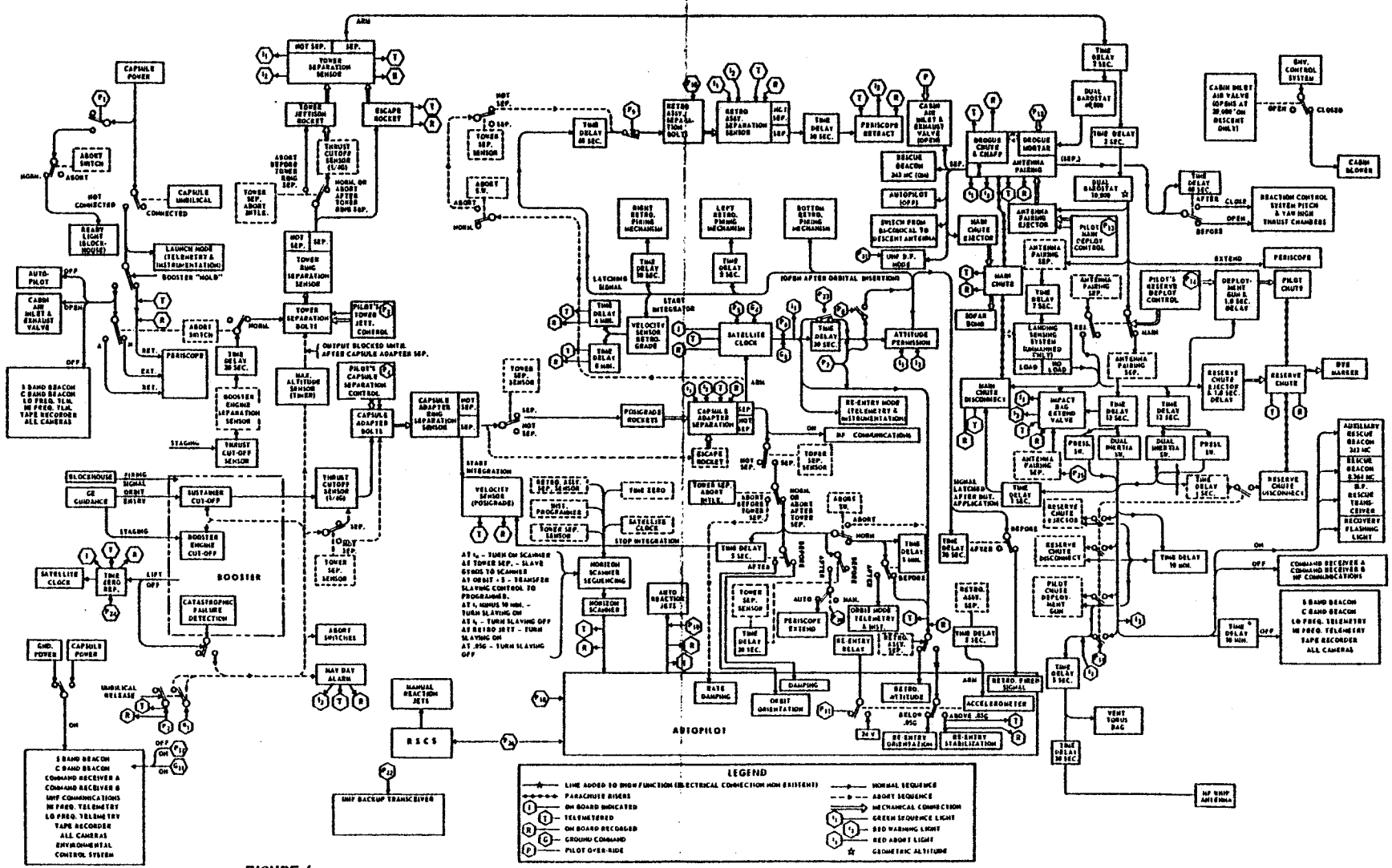


FIGURE 6

2.5.7.1

3.13 ELECTRICAL POWER SUPPLY SYSTEM - The electrical power supply system shall consist of 6 batteries which comprise the main, standby and isolated power supplies. Inverters shall be used for conversion of D.C. power to A.C. power. All batteries shall have individual diode reverse current protection for prevention of unnecessary power consumption because of a weak or faulty battery. Each battery shall be sealed at sea level pressure to withstand a pressure of 14.7 psi both internally and externally, and shall have a pressure relief valve for maintaining internal pressue between 5 psi and 14.7 psi as required. The batteries shall be vented for release of gas only with vent lines passing through the large pressure bulkhead and terminating in the capsule skin just aft of the bulkhead such that the gas vents overboard. Voltage monitoring shall be provided by the voltmeters located on the main instrument panel. Electrical loads shall be categorized as essential and nonessential and applied through separate busses through separate fuse panels. In event of low battery voltage, the nonessential bus automatically shall be switched "off". The D.C. power control system shall be as depicted in Figures 7a and 7b, Pages 71 and 72.

3.13.1 MAIN POWER SUPPLY - The main power supply shall consist of one 3000 watt/hour silver zinc battery, and three 1500 watt/hour silver zinc batteries in accordance with MAC Drawing No. 45-79707. (See Appendix I-C, Item 4 herein for electrical components.) Terminal voltage of these batteries shall average approximately 23 volts with a maximum of 29.6 volts and a minimum of 18 volts. The main batteries shall be wired in parallel with power inserted or withdrawn from the parallel circuit by an adjacent "on-off" switch. The main batteries shall be capable of providing power requirements for the mission as defined in Paragraph 1.1.1 herein. R-2

3.13.2 STANDBY POWER - The standby power supply in accordance with MAC Drawing No. 45-79707, shall consist of one 1500 watt/hour silver zinc battery with voltage taps of 24, 18, 12 and 6 volts. The standby battery shall have capacity sufficient to provide power to capsule equipment for two orbits as well as the 12 hour requirement for post landing components. Selection of automatic or manual standby operation shall be made by a switch provided on the main instrument panel (see Paragraph 3.8.9.7). Selection of automatic mode shall insert standby power into the main power supply system should a failure or low voltage occur. A standby DC warning light shall become illuminated at this time and all nonessential loads deprived of power. The standby system shall automatically continue to supply power to essential loads automatically until the astronaut places the switch in the manual standby position which will insert standby power in the main and secondary busses. The standby battery shall have sufficient capacity to provide a power source for the rescue beacon and rescue voice communications. R-2

3.13.2.1 ISOLATED POWER - The isolated power supply in accordance with MAC Drawing No. 45-79709, shall consist of one 1500 watt/hour silver zinc battery with voltage taps of 24, 18, 12 and 6 volts. The isolated battery system shall have sufficient capacity to provide power to the pyrotechnic actuated devices (see Paragraph 3.20). The isolated battery shall supply power to the audio bus for rescue communications if the audio bus switch is placed in the "Emerg" position by the astronaut. Isolated battery power may be inserted into the standby battery circuit if the isolated battery switch is placed in the "Standby" position by the astronaut.

3.13.3 A.C. POWER SYSTEM - The A.C. power system shall consist of two main and one standby static inverters and filters, for conversion of 24 volt D.C. power to 115 volts, single phase, 400 cycles A.C. power.

3.13.3.1 MAIN A.C. POWER SYSTEM - The main A.C. power system shall consist of one 250 VA static inverter and one 150 VA static inverter, in accordance with MAC Drawing No. 45-79709. The 250 VA inverter shall supply A.C. power to the ASCS, horizon scanners, rate indicating system and humidity indicator and cabin lights. The 150 VA inverter shall supply A.C. power to the environmental control system orbit fans. The inverters shall supply A.C. power as specified during the launch, orbit and re-entry phases until 0.05g at which point, the 150 VA inverter shall supply power to the ASCS, etc. and the 250 VA inverter shall supply power to the fans.

3.13.3.2 STANDBY A.C. POWER - The standby A.C. power system shall consist of one 250 VA static inverter in accordance with MAC Drawing No. 45-79709. The standby inverter shall supply A.C. power to the ASCS or fans, dependent upon the position of the standby inverter switch. If the switch has been placed in the "Auto" position, and a compound main inverter failure should occur, the fans shall be supplied A.C. power from the standby inverter. Upon failure of either of the main inverters, the appropriate circuit shall be de-energized and the standby inverter shall supply A.C. power to the equipment formerly powered by the main inverter.

3.13.4 ELECTRICAL CONNECTIONS - Design of the electrical system shall be such that there shall be no exposed electrical connections within the capsule to allow shorting by corrosive atmosphere and floating debris.

3.13.4.1 UMBILICAL CONNECTIONS - In order to maintain a fully charged condition on the batteries and to provide power for ground testing of various systems within the capsule, external power shall be supplied to the capsule prior to launching through an umbilical cable and

3.13.4.1 UMBILICAL CONNECTIONS (Continued)

disconnect assembly in accordance with MAC Drawing No. 45-79723-1. This cable shall be attached to the capsule mating receptacle through the open periscope door. The umbilical coupling device shall afford a secure and positive capsule connection which shall be capable of being released both electrically by a solenoid release mechanism and manually by a lanyard release. It shall be the responsibility of the umbilical connection to provide for the transfer of Freon 114 to the capsule during pre-launch operations:

D.C. POWER CONTROL SYSTEM SCHEMATIC

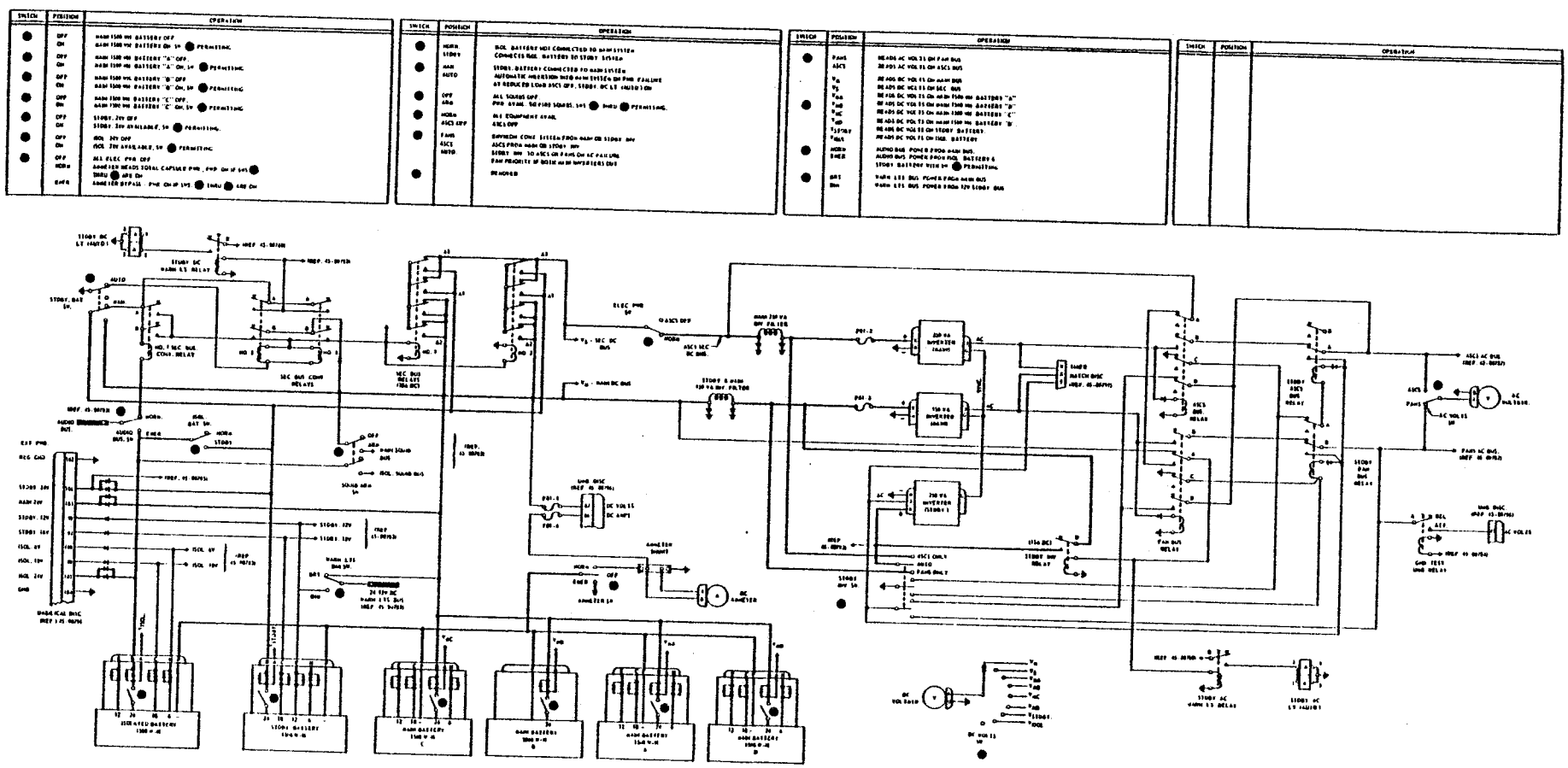


FIGURE 7a

[redacted]

POWER SYSTEM CONTROL

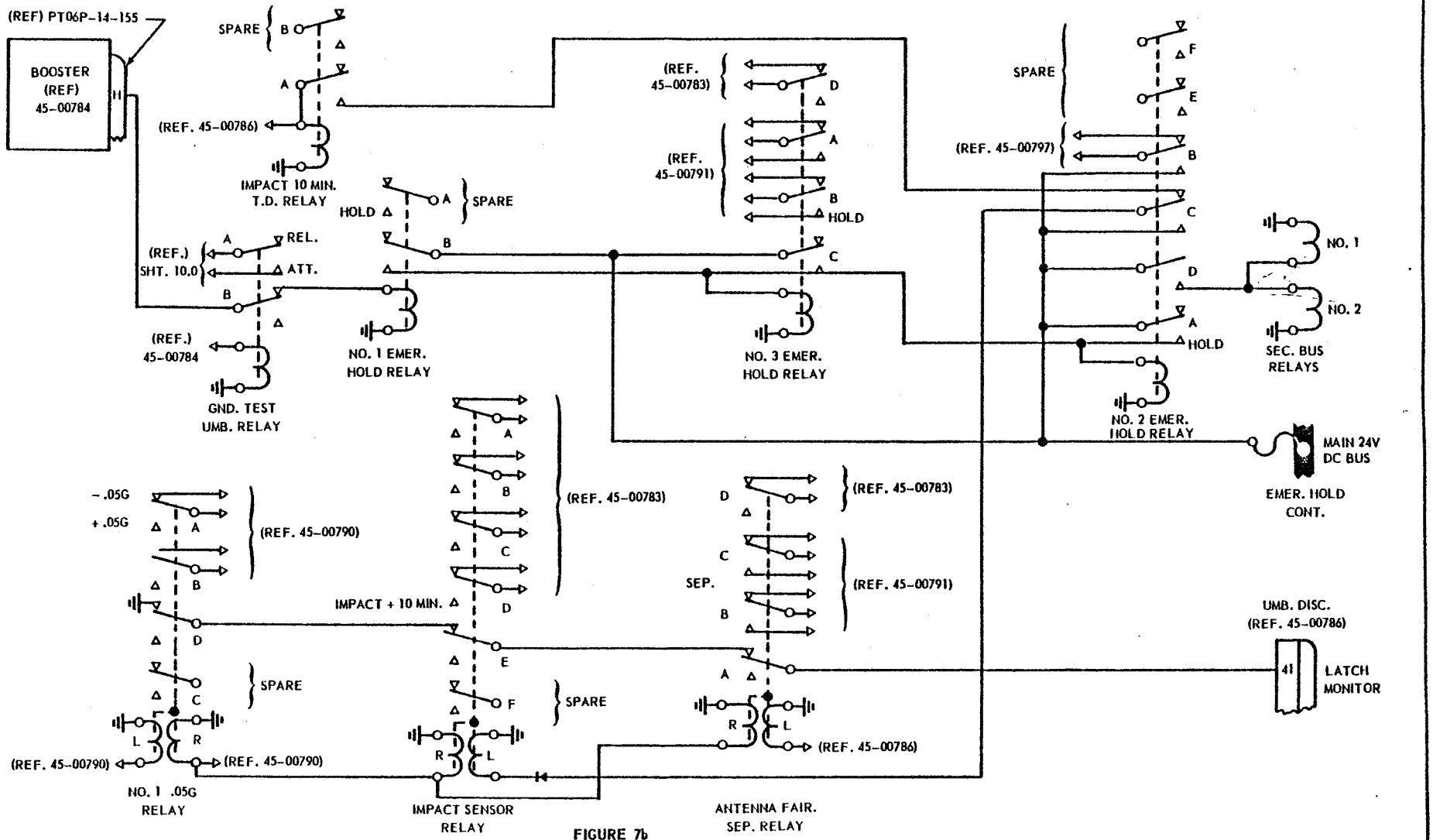


FIGURE 7b

2.5.5
2.5.5.1
2.5.5.2
2.6.3.1.1

3.14 COMMUNICATIONS SYSTEM - The communication systems provided aboard the Mercury Capsule shall be compatible with the world-wide ground station complex. Wherever practicable, the systems of telemetry, tracking, and voice communications now existing will be used. The following systems of communications in accordance with MAC Drawing No. 45-85700 shall be provided aboard the capsule:

a. Two-way HF/UHF orbital voice communications

b. Command receivers - ground to capsule

c. Telemetry equipment - capsule to ground

d. Deleted R-2

e. C-band radar tracking beacon

f. S-band radar tracking beacon

g. HF/UHF - Rescue beacon

h. HF Rescue voice communication

i. Deleted

j. UHF back-up orbital voice communications

k. UHF auxiliary rescue beacon

2.5.5.2.1

3.14.1 TWO-WAY HF/UHF ORBITAL VOICE COMMUNICATION - The two-way orbital voice communication systems shall consist of an amplitude modulated HF transmitter-receiver and UHF transmitter-receivers. The HF transmitter-receiver shall operate on a 15.016 megacycle frequency and shall have a 5.0 watt output and 5 microvolt sensitivity for 10 db signal-to-noise ratio and shall contain provisions for 12 db level speech clipping. R-2 The UHF transmitter-receivers shall operate on 296.8 megacycles and shall have a 3.5 microvolt sensitivity for 10 db signal-to-noise ratio and shall contain provisions for 12 db level speech clipping. The basic UHF unit as described herein and back-up UHF unit as described in Paragraph 3.14.4.4.3 shall be identical units having a 0.5 watt power output. The basic unit shall drive a 2.0 watt amplifier. A switch located on the radio section of the instrument panel (as depicted in Figure 4, Page 26 herein) and labeled "Hi-Power" and "Low-Power" shall permit the astronaut to

3.14.1 TWO-WAY HF/UHF ORBITAL VOICE COMMUNICATION - (Continued)

switch from the basic UHF unit with the 2.0 watt power output to the back-up 0.5 watt UHF unit. Either of the UHF units as selected by the astronaut shall be automatically energized at antenna fairing deployment at 10,000 feet and shall operate continuous transmission for direction finding in the recovery phase.

3.14.1.1 AUDIO BOX - The audio box shall contain a voice controlled transmit-receive relay switch and associated circuitry to activate the selected transmitter-receiver. The threshold level of the VOX shall be field adjustable. The unit shall also contain transistorized audio amplifiers for microphone and headphone circuits, a voice filter for the command receivers, and associated relays and switches. This unit shall be automatically energized after capsule separation. Prior to this time, the astronaut must depress the "push-to-talk mike" button to transmit via the voice communication unit selected. R-1

2.5.5.2.2 3.14.2 COMMAND RECEIVERS - Two frequency modulated transistorized command receivers similar to AN/DRW-13 receivers shall be provided. Each command system shall provide a total of twenty (20) decoder outputs, consisting of ten (10) channels in each of the receivers and ten (10) channels in each of the two (2) decoders provided. Each command receiver shall operate on a frequency of 414.0 megacycles and shall be compatible with FRW-2 ground command transmitters. The receivers shall have a 5 microvolt sensitivity for simultaneous five (5) channel operation. The units shall have decoder provisions for the retrograde rocket and satellite clock commands. The command receivers shall accept and decode the following commands: 1) abort (G-1); satellite clock reset (G-4); retrograde rocket fire (G-5); and, S and C-Band beacons "on" (G-11). Verification of commands shall be telemetered. Receipt of a retrograde rocket firing reset command shall be indicated by an amber warning light located on the warning light panel (see Paragraph 3.8.9.4.1). It shall be possible to use the command receivers for emergency voice communications. R-2

2.5.5.2.2 2.6.3.3 2.6.3.3.1. 3.14.3 TELEMETRY - Telemetry equipment to be provided shall be a high frequency telemetry transmitter, a low frequency telemetry transmitter and power supplies. Data shall be telemetered to ground stations to provide necessary real time information concerning the astronaut, capsule, and life support system. Telemetry shall afford back-up in the event that onboard data are not retrieved. Reliability shall be obtained through the use of two independent telemetry systems. R-2

2.5.5.2.3
2.6.3.3.1
2.6.3.3.2
2.6.3.3.4

3.14.3.1 LOW FREQUENCY TELEMETRY TRANSMITTER - The low frequency telemetry transmitter shall operate on 225.7 megacycles with a transmitted power output of 3.3 watts. This unit shall transmit scientific and aero-medical information by means of 4 IRIG standard FM subcarriers, one containing PAM modulation (10.5 kc subcarrier) which shall provide 90 data samples, each measured 1-1/4 times per second. This unit shall be capable of 4-1/2 hours continuous operation. Continuous or intermittent ground command operation may be selected on the ground prior to flight. Control of this unit from the ground shall be through the command receivers. Upon interrogation, the system shall operate for 6 minutes, at which time it shall automatically turn itself off and be in ready status for the next interrogation. R-2

2.6.3.3.2
2.6.3.3.4
2.6.3.3.1

3.14.3.2 HIGH FREQUENCY TELEMETRY TRANSMITTER - The high frequency telemetry transmitter shall operate continuously on 259.7 megacycles with a transmitted power output of 3.3 watts. This unit shall have the capability of transmitting a power output of 0.6 watts by a simple ground modification required for conversion to the lower power. R-2

3.14.3.3 TELEMETER POWER SUPPLY - Two (2) identical transistorized power supplies shall be provided, one for each transmitter. The power supplies shall operate from the capsule D.C. power supply. R-2

3.14.4 TRANSPONDERS AND BEACONS -

3.14.4.1 Deleted R-2

2.5.5.2.3
2.5.5.2.5

3.14.4.2 C-BAND BEACON - The C-Band radar tracking beacon shall be compatible with the FPS-16 radar system. The C-Band beacon transponder shall consist of a transistorized receiver operating on a 5480.0 megacycle frequency and a transistorized transmitter (except for its magnetron) operating on a 5555.0 megacycle frequency. The transponder input shall be double pulse coded and shall provide sufficient receiver sensitivity to normally attain a range of 805 statute miles (700 nautical miles) at orbital altitude. Power output of this unit shall be 375 watts peak. R-2

2.5.5.2.5

3.14.4.3 S-BAND BEACON - The S-Band radar tracking beacon shall be compatible with the SCR-584 Mod. II radar and the VERLORT long range radar. The S-Band beacon transponder shall consist of a receiver operating on a 2900.0 megacycle frequency and a transmitter operating on a frequency of 2950.0 megacycles. The transponder input shall be double pulse coded and shall provide sufficient receiver sensitivity to normally attain a range of 805 statute miles (700 nautical miles) at orbital altitude. Power output of this unit shall be 1000 watts peak. R-2

3.14.4.4 RECOVERY AIDS -

2.5.5.4.2
2.5.5.4

3.14.4.4.1 HF/UHF RESCUE BEACON - The rescue beacon shall facilitate recovery operations. This unit shall be a HF/UHF/MCW pulse modulated unit containing 243 megacycle SARAH rescue beacon and 8.364 megacycle MCW portion of the SEASAVE beacon. The HF beacon shall have a transmitted power output of 1.0 watt and the UHF beacon shall have a transmitted peak power output of 7.5 watts. The HF transmitting portion of the rescue beacon shall be primarily for sky wave propagation and shall have sufficient range for sending a high frequency signal into the ionosphere and returning this signal to scattered global localities for purposes of establishing contact with randomly spaced, ground based direction finding stations typical of those under the direction of the monitoring bureau of the FCC. The UHF transmitting portion of the rescue beacon shall be primarily for establishing contact with airborne search vehicles and shall have a line of sight range of at least 200 nautical miles. The HF/UHF rescue beacon shall receive its power from the 1500 watt/hour isolated battery. R-2

3.14.4.4.1.1 UHF AUXILIARY RESCUE BEACON - A second, completely independent UHF rescue beacon shall be provided to aid in capsule recovery. This shall be a UHF pulse modulated "Super Sarah" unit which shall operate on a frequency of 243 megacycles with a transmitted power output of approximately 200 watts peak.

3.14.4.4.2 HF RESCUE VOICE COMMUNICATIONS - The HF rescue voice communication system shall consist of an amplitude modulated HF transmitter-receiver using the same basic modules as the HF orbital voice communication system described in Paragraph 3.14.1 except that the rescue unit shall have a power output of 1.0 watt. This unit shall receive its power from the 1500 watt/hour isolated battery. R-2

3.14.4.4.3 UHF BACK-UP ORBITAL VOICE COMMUNICATIONS - The UHF back-up orbital voice communication system shall consist of an amplitude modulated UHF transmitter-receiver using the same basic modules as the UHF orbital voice communication system described in Paragraph 3.14.1, except that the back-up unit shall have a 0.5 watt power output and will not drive the 2.0 watt amplifier. This unit shall be automatically energized at antenna fairing deployment for continuous transmission for direction finding in the recovery phase if selected by the astronaut. This unit shall have a useful range of at least 200 nautical miles when operated in conjunction with compatible rescue equipment. Power for this unit shall be received from the 1500 watt/hour isolated battery. R-1

3.14.5 COMMUNICATIONS CONTROL PANEL - A communications control panel shall be provided in the lower right-hand corner of the instrument panel. The control panel shall contain audio mixing circuitry, volume controls for the HF, UHF and emergency command voice channels, a "morse code" keying button for high frequency telemetry transmission control, and a direction finding switch which shall enable the astronaut to use the energized UHF transmitter-receiver as selected for normal transmission and reception. R-2

3.14.5 COMMUNICATIONS CONTROL PANEL - (Continued)

The volume controls shall be vertically mounted. It shall be possible for the astronaut to rotate the volume controls with a fully inflated pressure suit by gripping the edge of the instrument panel with his fingers and rotating the control with his thumb. A "push-to-talk mike" button shall be provided on the abort handle (see Paragraph 3.8.8.2.2). This must be used by the astronaut for transmission via the selected communications unit prior to capsule separation. The communications audio control shall receive aural alarm signal inputs from the warning system tone generator (see Paragraph 3.8.9.4.1). The aural alarms shall result in a steady tone audible through the astronaut's headset. R-2

2.5.5.3 3.14.6 ANTENNAS - Antennas shall be provided for all communication systems. Antennas for each system shall provide the required coverage for each phase of the mission. Recovery system antennas shall be mounted in such a manner as to prevent loss of signal from water or salt spray. Multiplexers, diplexers, coaxial switches and miscellaneous RF components shall be utilized where necessary to limit the number of antennas.

2.5.5.3 3.14.6.1 C AND S-BAND ANTENNA - A C and S-Band antenna system capable of operation during all phases of the mission shall be provided. The C and S-Band beacons shall remain energized until 10 minutes after impact through a time delay energized by the landing system dual inertia switch as indicated on the sequential schematic, Figure 6, Page 67 . This antenna system shall consist of three flush helices for each of the two beacons to provide omnidirectional coverage, with a power divider for each of the two beacons and matched cabling from the power dividers to the antennas. Each antenna shall be capable of separate or simultaneous operation. The C and S-Band antennas shall be externally located in a band around the capsule conical section near the junction of the cylindrical recovery compartment. R-1

2.5.5.3 3.14.6.2 BICONICAL ANTENNA - The biconical antenna shall operate during pre-launch, launch, orbit and re-entry phases of the mission. This antenna shall be incorporated into the antenna housing, and shall be jettisoned at 10,000 feet altitude with the fairing. Through a multiplexing system, the HF and UHF orbital voice communications, both UHF command receivers, both telemetry transmitters shall utilize the biconical antenna. R-2

3.14.6.2.1 MULTIPLEXER - A multiplexer shall be provided to permit simultaneous or individual operation of HF/UHF transmitter-receivers (excluding DF mode of UHF) high and low frequency telemetry transmitters and both command receivers into the biconical antenna. The multiplexer shall be compatible with the UHF descent antenna for use after jettison of the biconical antenna. This unit shall be located in the capsule pressurized area.

2.5.5.3 3.14.6.3 UHF DESCENT ANTENNA ARRAY - A wire butterfly type descent antenna shall be provided for supplying omnidirectional coverage. This antenna shall permit simultaneous operation of both telemetry transmitters, UHF back-up voice transmitter-receiver, UHF rescue beacon, and UHF command receivers. The descent antenna shall be located on the capsule parachute housing structure. This antenna shall be tethered until after main chute (or reserve chute) deployment to prevent possible damage from the chute risers. This antenna shall be spring loaded and shall be extended into the erect operating position after a 16 second time delay from antenna fairing separation by means of a reefing cutter which shall sever the tie-down cord upon actuation. R-1

2.5.5.3 2.5.5.4.2 2.5.5.4.4 3.14.6.4 HF RESCUE ANTENNA SYSTEM - A telescopic whip-type antenna shall be provided for use with the HF rescue beacon. This antenna shall be stowed in the recovery compartment and shall be automatically extended by the landing system dual inertia switch (See Paragraph 3.17.2.5) after parachute ejection. The antenna shall extend to 16 feet when in operating condition. R-2

3.14.6.5 HF DIPLEXER - A HF diplexer shall be provided for use during the recovery phase to connect the output of the HF portion of the HF/UHF rescue beacon and the HF rescue voice transmitter to the HF rescue (balloon) antenna. The diplexer shall be located in the capsule pressurized area.

3.14.6.6 UHF RESCUE BEACON ANTENNA - An independent whip type antenna system shall be provided for operation of the "Super Sarah" beacon only.

3.14.7 Deleted

3.14.8 COAXIAL SWITCHES - Two single pole, double throw, motor-operated coaxial switches shall be provided for switching from the biconical antenna to the UHF descent antenna upon main parachute deployment at 10,000 feet altitude and for switching to the UHF back-up voice transmitter-receiver, as selected by the astronaut.

3.14.9 COAXIAL CABLES AND CONNECTORS - Raytherm Type 12-090S, 12-233 or 12-234 coaxial cable shall be used for all interconnections between the electronic equipment and antennas. Coaxial connectors shall be of the miniature type.

2.6.3
2.6.3.1

3.15 RECORDING EQUIPMENT - Recording equipment meeting the requirements of Specification MIL-E-5272A-1 and MIL-E-5400B(ASG) shall be comprised of equipment as specified in the following paragraphs. A satisfactory isolation technique shall be employed to avoid crosstalk or interference between systems being fed from common pick-ups. Methods of data recording within the capsule shall be as noted below, and as depicted in Figure 8, Page 82 herein. In addition telemetry equipment for transmitting data from the capsule to ground stations shall be provided as specified in Paragraph 3.14.3. R-1

a. Photographic recording of astronaut.

b. Photographic recording of instrument panel.

c. Deleted

d. Tape recording of data and voice.

e. Photographic recording of cosmic ray collisions.

f. Deleted

3.15.1 CAMERAS - Cameras shall be provided as follows:

2.6.3.5.1

a. ASTRONAUT OBSERVER CAMERA - A 16mm motor operated camera in accordance with MAC Drawing No. 45-88704 shall be provided for observation and recording of astronaut motion and appearance. Film capacity of the astronaut observer camera shall be 250 feet (10000 frames) using cronar base 16mm film, with frame rates of 3 frames per second during launch and re-entry trajectories and 1 frame per 3 seconds during orbital flight. Frame rates shall be generated by signals from the data programmer. R-2

2.6.3.5.1

b. INSTRUMENT OBSERVER CAMERA - A 16mm motor operated camera in accordance with MAC Drawing No. 45-88704 shall be provided for observation and recording of instrument displays. Film capacity of the instrument observer camera shall be 500 feet (20000 frames) using cronar base 16mm film, with frame rates of 3 frames per second during launch and re-entry trajectories and 1 frame per 10 seconds during orbital flight. Frame rates shall be generated by signals from the data programmer. R-1

c. Deleted

2.6.3.4
2.6.3.2
2.6.3.3.3

3.15.2 TAPE RECORDER - A tape recorder in accordance with MAC Drawing No. 45-88707, shall be provided for permanent data storage. The recorder shall function continuously during all phases of the mission and for 10 minutes after impact for recording of astronaut comments and observations. All voice messages sent to ground stations by the astronaut shall be recorded by this equipment. The tape recorder shall be compatible with the pulse duration modulation system, subcarrier oscillators (VCO) and direct recording mediums. This unit shall have seven heads for recording data at a tape speed of 1-7/8 ips. Tape capacity shall be 4800 feet of 1/2 inch mylar base-tape. A limit switch shall be provided for interrupting power to the recorder in event of tape breakage. Recording tracks shall be as follows: R-2

Track No. 1 - Direct Recording - VCO mixer output

Track No. 3 - Direct Recording of UHF voice below 3125 cps

Track No. 5 - Pulse Recording - composite PDM signal from Commutator/Keyer unit "B" (see Figure 8)

Track No. 7 - Pulse Recording - composite PDM signal from Commutator/Keyer unit "A" (see Figure 8)

2.6.3.4

3.15.2.1 COMMUTATED DATA RECORDING - Two PDM/PAM commutator/keyer systems, in accordance with MAC Drawing No. 45-88709, shall be provided. These units shall commutate transducer data and shall supply PDM and PAM outputs. The commutator portion of each unit shall signal inputs at a rate of 112-1/2 samples per second providing 90 data samples, each measured 1-1/4 times per second, producing a signal wave train. The PAM wave train output shall be transmitted to the PAM/PDM converter. The PDM output shall be supplied to a record amplifier which shall produce a signal capable of directly driving a record head in the tape recorder. The PAM output shall be transmitted to ground station automatic decommutation equipment. Each unit shall have its own power to provide required voltages. R-2

2.6.2.5

3.15.3 COSMIC RAY FILM PACK - Four photographic recorders of cosmic ray collisions shall be installed in the capsule. These shall be furnished by NASA and shall be installed at the launch site (see Appendix I-A). R-1

2.6.3.2

3.15.4 DATA PROGRAMMER - A data programmer in accordance with MAC Drawing No. 45-88710 shall be provided for intermittent operation of the environmental control system water absorber, horizon scanners, cameras, tape recorder, telemetry transmitter, and calibration of transducers during orbital and post landing phases. R-1

3.15.5 SOUND AND VIBRATION MEASURING SYSTEMS - A sound level measuring system in accordance with MAC Drawing No.45-88713 shall be provided. This system shall consist of a piezoelectric/diaphragm type microphone which shall pick up pressure levels from 110 to 140 decibels in a frequency range of 37 to 9600 cps. It is anticipated that the sound pressure level during the launch phase may be approximately 135 decibels. Vibration measurements shall be recorded by the vibration measuring system provided in accordance with MAC Drawing No. 45-88714. This system shall consist of a piezoelectric transducer for vibration pick-up in a frequency range of 10 to 2000 cps and a vibration amplifier for increasing the output of the transducer to a level compatible with the vibration and acoustical (spectrum) analyzer, provided in accordance with MAC Drawing No. 45-88711. This analyzer shall receive and convert acoustical and vibration data to amplitude versus frequency signals for recording as indicated in Figure 8, page 82 herein.

3.15.6 VOLTAGE CONTROLLED SUBCARRIER OSCILLATORS - Voltage controlled subcarrier oscillators in accordance with MAC Drawing No. 45-88700 shall be provided. PAM outputs from the commutators, 3 volt D.C. and pitch, roll and yaw signals from the rate package shall apply instrumentation data voltages to the subcarrier oscillators.

3.15.6.1 COMPENSATING OSCILLATORS - A compensating fixed frequency oscillator in accordance with MAC No. 45-88700 shall be provided for monitoring wow and flutter. This shall be adjusted to operate at 3125 cps with an adjustable voltage output.

3.15.6.2 MIXER AMPLIFIER - Two mixer amplifiers in accordance with MAC Drawing No. 45-88700 shall be provided for capsule power conversion from 24 volts D.C. to 6 volts D.C. for use by the subcarrier oscillators. These units shall mix and amplify oscillator outputs for the tape recorder and telemetry transmitters.

BASIC INSTRUMENT SYSTEM BLOCK DIAGRAM

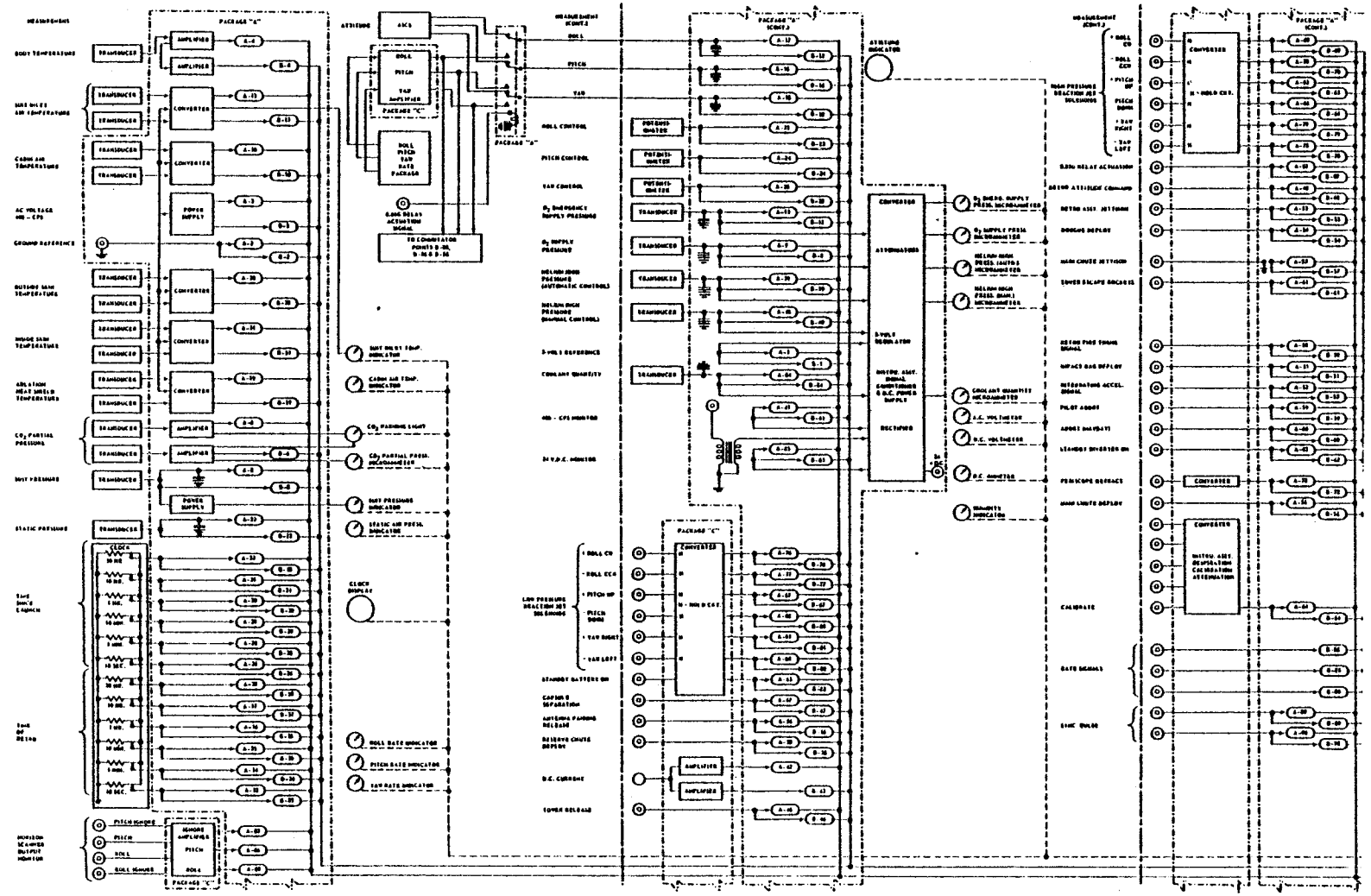
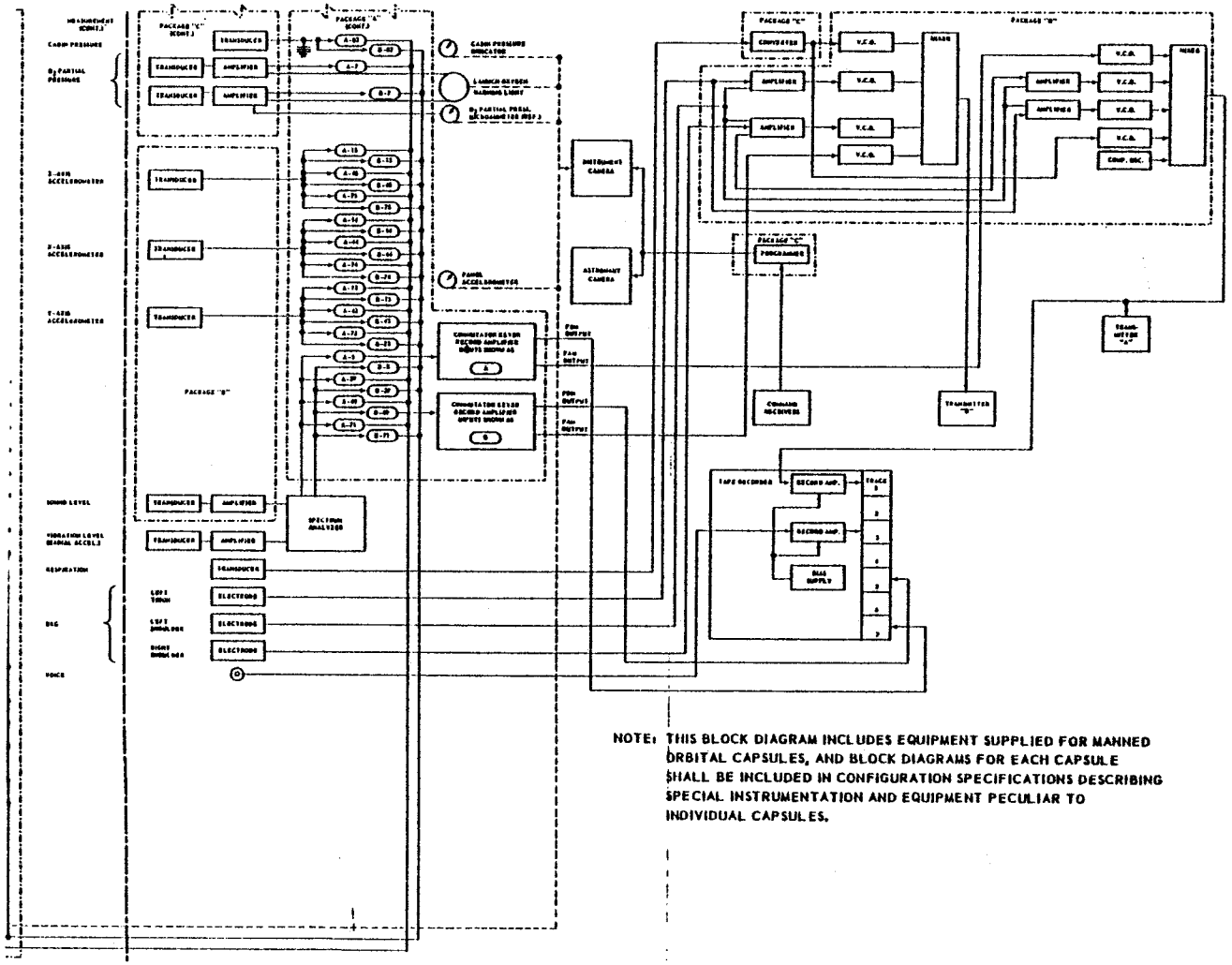


FIGURE 8



NOTE: THIS BLOCK DIAGRAM INCLUDES EQUIPMENT SUPPLIED FOR MANNED ORBITAL CAPSULES, AND BLOCK DIAGRAMS FOR EACH CAPSULE SHALL BE INCLUDED IN CONFIGURATION SPECIFICATIONS DESCRIBING SPECIAL INSTRUMENTATION AND EQUIPMENT PECULIAR TO INDIVIDUAL CAPSULES.

2.5.6 3.16 NAVIGATIONAL AIDS - The Astronaut shall be provided with manual navigational aids which shall allow basic navigation without communication or automatic system references. (See Paragraph 3.8.9.6 for dead reckoning earth path indicator.)

2.3.3.3.2 2.5.4.2 2.5.6.1 2.5.6.2 3.16.1 PERISCOPE - An optical periscope, in accordance with MAC Drawing No. 45-86701, shall be provided. (See Appendix I-C, Item 3.18 herein.) This unit shall be located so as to partially support the instrument panel (see Paragraph 3.8.9) such that its display appears in the lower center of the instrument panel. This installation shall provide an optical reference point at FZ 135.59, TY 5.780 and XO.00 station lines, based upon an astronaut's eye reference point at FX 118.20, TY 22.82 and RX 1.28. The periscope shall provide an 8 inch diameter circular display with the image plane inclination at approximately 45 degrees from the YO.00 axis. The periscope circular display shall provide the following: R-1

a. Outer view of the horizon circle.

b. Center view of the spherical earth.

c. High and low magnification of the center view of the point where the vertical intersects the earth's surface. The low magnification shall provide a complete horizon to horizon view. The high magnification center field view shall provide a maximum of 30 degrees with magnification increased accordingly. Magnification view shall be adjustable by actuation of the magnification control provided on the left-hand side of the periscope body.

d. Target index located in the center for definition of earth position relative to intersection of vertical with the earth's surface.

e. Adjustable altitude indices and visual altitude indication.

f. Attitude indices for indication of pitch and roll attitudes.

g. -34 degree retrograde pitch attitude fixed indices.

h. Fixed reticle lines shall be provided for earth and sky camera field of view when capsule is aligned to vertical.

i. Fixed reticle lines for alignment of the capsule normal axis with the earth vertical.

j. A -14° 30' true vertical index on upper portion of display.

3.16.1 PERISCOPE - (Continued)

k. Drift indices and drift set scale for capsule orientation with the ground track.

l. Sun-moon index - A graduated settable 360 degree index about the perimeter for measurement of the angle of the rising or setting sun or moon relative to the capsule longitudinal axis. A high density sun filter shall be provided for viewing of the sun without eye discomfort or damage.

m. Clear, yellow, red and neutral density optical filters shall be manually selected by the astronaut.

The lower optical portion of the periscope and the periscope access door shall extend or retract automatically with provisions for manual override. Automatic extension and retraction shall occur in less than 5 seconds each. An amber light located on the upper left of the periscope display shall illuminate at any time when the lower optical portion of the periscope is in any position between locked extended and locked retracted in the retract cycle.

2.5.6.2 3.16.1.1 PERISCOPE CONTROLS - The following controls shall be provided on the periscope:

a. Reticle illumination control knob
b. Altitude knob and indicator
c. Drift knob
d. Sun-moon index control lever

) On periscope face

e. Two-position (high and low) magnification change lever - 30 degree total travel.
f. Four-position filter selector lever - 30 degree travel.

) On Left-Hand Side of Body

g. Manual extension and retraction control lever - 45 degree total travel - On right-hand side of body.

2.5.6.2 3.16.2 NAVIGATIONAL AID KIT - A navigational aid kit in accordance with MAC Drawing No. 45-81089, shall contain maps, cards, pencil and hand computer. These navigational aids shall be bound together in a booklike fashion in accordance with MAC Drawing No. 45-81087, for simplicity, convenience and ease of handling. The navigational aid kit shall be mounted to the periscope directly below the circular display. All navigational aid kit functions may be performed with inflated pressure suit gloves. R-1

2.5.6.2 3.16.2.1 STEREOGRAPHIC MAPS - Polar stereographic maps in accordance with MAC Drawing No. 45-81706, shall be provided.

2.5.6.2 3.16.2.2 HAND COMPUTER - A circular hand computer in accordance with MAC Drawing No. 45-81084 shall be provided for use by the astronaut for general and special computational purposes. The computer shall contain standard one cycle "C" and "D" slide rule scales, with related standard sine and tangent scales; navigation scales relating velocity, distance, and time, to radius and angle; and scales to determine drift corrections as a function of position latitude between +60° and -60°, altitude between 50 and 250 nautical miles, and orbital inclination of +30° to -30°. Nomenclature and markings shall be black on dull white or natural anodize of suitable size and contrast for astronaut resolutions at a distance of 25 inches. R-1

2.5.6.2 3.16.2.3 CARDS - Check, chart, and note cards shall be provided as required by the mission as outlined in Paragraph 1.1.1.

2.5.6.2 3.16.2.4 PENCIL - A special pencil in accordance with MAC Drawing No. 45-81086 shall be provided. This pencil shall be usable for writing on clear plastic. A pencil holder and retention card assembly shall be provided for pencil storage and retention.

2.5.3 3.17 LANDING AND POST-LANDING AND SURVIVAL SYSTEMS - A capsule land-
2.5.3.1 ing system shall be provided, consisting of components tabulated
2.5.3.1.1 in Appendix I-C herein, Item 10. The landing system in accordance with MAC
2.5.3.1.2 Drawing No. 45-41700 shall include two independent parachute systems, sequencing R-1
controls, and post landing equipment. All parachutes, harnesses and parachute bags as specified herein shall be shipped directly to the launch site where they will be Government inspected and packed.

2.5.3 3.17.1 LANDING SYSTEM - The landing system shall consist of a primary
2.5.3.1 system comprising a main parachute, a drogue parachute, and
2.5.3.1.1 associated sequencing controls; and a reserve system comprising a reserve
2.5.3.1.2 parachute, a pilot parachute, and associated sequencing controls. The landing
2.5.3.3.3 system sequencing controls shall be armed by the tower separation sensor R-2
2.5.3.3.5 For missions aborted between 10,000 feet and 40,000 feet, a time delay between escape tower jettison and drogue chute deployment of a minimum of two (2) seconds shall provide a sufficient time lapse required for various functional sequences during the abort maneuver. For missions aborted at an altitude below 10,000 feet, a second time delay of two (2) seconds shall prevent simultaneous actuation of the drogue mortar and the antenna fairing ejector.

2.1.2.6.3 3.17.1.1 DROGUE PARACHUTE SYSTEM - A six (6) foot diameter conical ribbon
& 3.1.3 type drogue parachute assembly with a thirty (30) foot bridle
2.5.3.1.4 length, shall be provided for adequate dynamic stability and deceleration
2.5.3.2.1 during the re-entry phase. The drogue chute shall be constructed of cotton,
2.5.3.2.2 nylon and dacron materials and shall be designed for a dynamic pressure of
2.5.3.2.4 116 pounds per square foot considering deployment at a geometric pressure altitude of 40,000 feet. The drogue chute shall be stowed in a drogue chute bag. This assembly, a chaff packet, compatible with C, S, and L band radar, and a mortar sabot shall be located in the drogue mortar tube. At 42,000 feet barametric pressure altitude, a barostat (aneroid pressure switch) shall R-3 receive static pressure from a static plenum chamber, close a switch and complete an electrical circuit to a cartridge squib located under the mortar tube, initiating a gas charge. The gas charge shall force the mortar sabot, and drogue chute assembly from the mortar tube causing the chute to deploy. The drogue chute shall be attached to the antenna fairing by a 3-riser arrangement and shall be released by jettison of the antenna fairing.

2.5.3.1.4 3.17.1.2 MAIN PARACHUTE SYSTEM - The main parachute assembly shall be a
2.5.3.3.1 sixty-three (63) foot diameter reefed (12 percent for 4 seconds)
2.5.3.3.3 ring-sail type parachute designed to provide a stabilized sinking speed of R-2 thirty (30) feet per second at five thousand (5000) feet altitude for a two thousand one hundred sixty (2160) pound capsule. The main parachute of nylon material shall be designed and constructed to withstand shock loads encountered

3.17.1.2 MAIN PARACHUTE SYSTEM - (Continued)

at ten thousand (10,000) feet deployment altitude at velocities up to 295 feet per second true velocity. It shall be considered that there has been no velocity decrement occasioned by drogue chute deployment, so that drogue chute failure cases shall be completely covered. The main parachute shall be stowed in the cylindrical recovery compartment aft of the conical afterbody and its deployment bag lanyard shall be connected to the antenna fairing so that upon antenna jettison, the main chute, as it pulls out of the chute pack, shall be deployed. A parachute deployment bridle, fabricated from 1000# tubular nylon webbing, shall be attached to the apex of the parachute in such a manner that the loads encountered upon parachute deployment shall be distributed symmetrically about the apex. This shall take place at ten thousand (10,000) feet geometric pressure altitude as sensed by a barostat (aneroid pressure switch). The barostat shall complete an electrical firing circuit to the antenna fairing ejector assembly subsequently jettisoning the antenna fairing. The barostat shall also initiate extension of the periscope. Upon separation of the antenna fairing, the main chute ejector gas generator assembly shall be electrically initiated, and shall produce gas for injection into the main parachute ejector bag, which, with the antenna fairing, shall eject the main chute pack from the recovery compartment. As this occurs, the main chute shall pull out of the main chute deployment bag, releasing the antenna fairing, drogue chute and bag. At the time of main chute ejection, a SOFAR bomb, preset for sound ranging at a depth of thirty-five hundred (3500) feet, shall be ejected. (See Paragraph 3.17.2.1.) Separation of the antenna fairing shall energize the cabin air inlet and exhaust valve "open" circuit for ventilation in low altitude abort maneuvers; energize the 243 mc SARAH rescue beacon; de-energize the ASCS; energize the UHF beacon for direction - finding mode; switch from the bicone antenna to the UHF descent antenna; simultaneously energize a 60 second time delay relay and power and control relay which shall open the reaction control system pitch and yaw high level thrust chamber to expire H_2O_2; and, after a twelve (12) second time delay shall arm the impact sensor (dual inertia switch), pressure switch and the impact bag extend valve. Gore colors of the main parachute shall be natural and international orange alternately arranged. R-3

2.5.3.2.5 3.17.1.3 PILOT PARACHUTE - The pilot parachute shall be a flat circular type, seventy-two (72) inch diameter parachute with a 30 foot bridle length. Construction shall be of nylon cloth, with nylon webbing and cord, design for deployment in event of failure of the main parachute. Deployment of the pilot parachute shall be controlled by the astronaut through actuation of the "Reserve Deploy" switch (P-14) located on the left hand console. Upon actuation of the "Reserve Deploy" switch (P-14) the deployment gun main charge cartridge shall be initiated both electrically, provided antenna fairing separation has occurred, and mechanically. Actuation of the "Reserve Deploy" switch (P-14) shall also initiate electrically (after antenna fairing separation) the main chute disconnect squib cartridge, and initiates a 1.0 second time delay powder train which shall fire the deployment gun main charge cartridge, the reserve chute ejector squib, the impact bag extend valve actuation, and after a twelve (12) second time delay arm the impact sensor (dual inertia switch) and pressure switch. Actuation of the deployment gun main charge cartridge R-3

3.17.1.3 PILOT PARACHUTE - (Continued)

shall actuate the deploy gun projectile assembly to which the pilot chute bridle assembly shall be attached. The bridle assembly shall be attached to the projectile assembly on one end and to the pilot chute canopy on the other. Upon extraction of the pilot chute from the reserve chute bag, its lanyard shall pull the bag from the recovery compartment. The reserve chute shall then pull out of the bag, which shall be permanently attached to the apex of the reserve chute to assist development of a more symmetrical chute deployment.

2.5.3.3
2.5.3.3.1

3.17.1.4 RESERVE PARACHUTE - The reserve parachute assembly shall be a sixty-three (63) foot diameter reefed ring-sail type parachute identical in design, construction and reefing to the main parachute. The reserve parachute shall be stowed in the cylindrical recovery compartment, and its deployment bag shall be attached to the pilot chute lanyard, so that upon deployment of the pilot chute, the reserve chute deployment bag shall be extracted. As the pilot chute deploys, the reserve ejector gas generator assembly shall be electrically initiated and shall produce gas for injection in the reserve chute ejector bag which, with the pilot chute, shall extract the reserve chute pack from the recovery compartment. At the time of reserve chute ejection, an aluminum powder marker package, attached to the capsule by a lanyard, shall be ejected. (See Paragraph 3.17.2.2.) In a normal landing sequence where the reserve chute has not been deployed, the reserve chute shall be ejected from the capsule through the "rescue aids" toggle switch (P-15) after the pressure switch or the impact sensor (dual inertia switch) has become energized. The reserve chute shall also be ejected after run-out of a ten (10) minute time delay which shall become energized by closure of either the pressure switch or the impact sensor (dual inertia switch) upon impact. This time delay shall bypass the "rescue aids" toggle switch, and shall energize the same circuitry as the "rescue aids" toggle switch (P-15). R-2

2.5.3.1.2
2.5.3.3.4
2.1.2.6.4

3.17.1.5 IMPACT SKIRT - The capsule shall be equipped with a fiberglass/silicon rubber impregnated impact skirt in accordance with MAC Drawing No. 45-32700. The impact skirt shall be attached to the capsule structural assembly and to the ablation shield by a skirt retainer ring at 219 points equally spaced around the inside of the ablation shield on a radius of approximately 35 inches from the Z axis. The impact skirt shall be capable of withstanding landing impact loads for water and earth landings. A torus bumper of material conforming to MAC Drawing No. 45-32701 shall be installed on the periphery of the ablation shield and shall prevent the ablation shield from damaging the pressure bulkhead upon landing. The torus bumper shall be inflated to a design pressure of 10 psig at impact skirt extension. The impact skirt shall be capable of being extended by both automatic and manual systems. R-1

Automatic extension shall take place 12 seconds after antenna fairing separation. At this time, the explosive valves on the heat shield release system shall be ignited releasing pressure from the pneumatic tank, and this shall actuate the heat shield release mechanism allowing the ablation shield to drop down and extend the impact skirt. As the heat shield release mechanism reaches its extended limits, nitrogen stored under 3000 psi, from the pneumatic tank shall inflate the torus bumper. Upon impact, air shall be forced out of orifices near the bottom of the impact skirt allowing the capsule to settle to a normal attitude after impact. Actuation of the rescue aids switch by the astronaut or run-out of the ten (10) minute time delay shall start a sequence of events which shall include deflation of the torus bumper. (See Figure 6 Page 67 .) R-2

3.17.1.5 IMPACT SKIRT - (Continued)

Water shall be removed from the impact skirt/ablation shield cavity by hoisting the capsule and allowing the water to drain out through settling orifices and drain holes spaced about the bottom of the impact skirt.

2.5.5.4 3.17.2 POST LANDING SYSTEM - The post landing system shall include one SOFAR bomb, aluminum powder marker package, shark repellant package, and inertia switches for actuation of equipment essential to recovery. R-1

2.5.5.4.5 3.17.2.1 SOFAR BOMBS - Two (2) SOFAR bombs shall be installed. In a normal landing sequence, one of these shall be ejected at main chute deployment at 10,000 feet altitude. This bomb shall be armed to transmit signals at 3500 feet depth. The second bomb shall be used to transmit sound ranging signals at a depth of 4000 feet. This SOFAR bomb shall be permanently mounted to capsule structure and shall indicate that the capsule has submerged to an unrecoverable depth. R-2

2.5.5.4.6 3.17.2.2 ALUMINUM POWDER MARKER - An aluminum powder marker package shall be provided to aid in visual location during the search phase. In a normal landing sequence, the marker package shall be ejected after reserve chute ejection and impact on the water. In a landing where the reserve chute has been deployed, the marker package shall be ejected with the reserve chute. The powder shall be packaged in a water soluble container attached to the capsule by a retainer line.

2.5.5.4.7 3.17.2.3 SHARK REPELLANT - A shark repellant packet assembly shall be provided to aid in astronaut protection while in the water after egress. The shark repellant shall be packaged in a water soluble container attached to the outside of the impact skirt. R-2

2.5.5.4.3 3.17.2.4 RECOVERY FLASHING LIGHT - A high intensity flashing recovery light in accordance with MAC Drawing No. 45-86702-3 shall be provided. Flashing rate of the light shall be at least fifteen (15) flashes per minute at an intensity which shall be visible below twelve thousand (12,000) feet at a distance of approximately fifty (50) nautical miles on a star-lit moonless night at a relative humidity of at least ninety (90) per cent. The light shall have self-contained batteries. R-1

2.5.3.3.4 2.5.3.3.5 2.5.3.3.6 3.17.2.5 IMPACT SENSOR - The impact sensor (dual inertia switch) shall initiate the following functions: R-2

a. Initiate main parachute disconnect.

3.17.2.5 IMPACT SENSOR - (Continued)

b. Initiate the reserve parachute ejector and disconnect and the pilot parachute deployment gun after closing the "rescue aids" toggle switch (P-15)

c. Energize a ten (10) minute time delay which shall, upon run-out, initiate the reserve parachute ejector and disconnect and the pilot parachute deployment gun in the event that the "rescue aids" toggle switch (P-15) remains open. R-2

d. Energize HF rescue antenna for HF SEASAVE direction finding beacon and HF rescue transceiver.

e. Energize SEASAVE beacon.

f. Energize HF rescue transceiver.

g. Energize the auxiliary UHF rescue beacon.

h. Start recovery flashing light.

i. De-energize excess communications and instrumentation.

j. Energize a time delay to maintain S-Band and C-Band beacons, low and high frequency telemetry units, the tape recorder and camera operation until ten (10) minutes after impact.

k. Arm a 5 second time delay which shall be energized by closing the "rescue aids" switch (P-15) circuit. This time delay relay shall vent the torus bag, energize a 30 second time delay relay which shall initiate the HF whip antenna extension.

3.17.2.5.1 PRESSURE SWITCH - In event of malfunction of the impact sensor (dual inertia switch) the pressure switch shall initiate the functions as defined for the impact sensor, Paragraph 3.17.2.5 herein. R-2

3.17.2.6 Deleted

3.17.3 SURVIVAL KIT - Survival Equipment as supplied by the Government (See Appendix I-A) shall be contained in a contractor furnished container conforming to the requirements of MAC Drawing No. 45-81029. The container shall be partitioned into two compartments; one (snap enclosed) for housing a modified PK-2 one-man raft; and one (zipper enclosed) for housing the balance of the survival gear. A lanyard, 96.0 inches long, with a snap fastener shall be provided to join the astronaut, survival kit and/or capsule together. A retention line shall be provided in the container for connecting the life raft and survival kit. Stowage provisions shall be made for the astronaut's suit neck dam and for the knife and flashlight at time of egress. The survival kit container shall be 22.6 inches long, 9.5 inches wide and shall have maximum thickness of 3.0 inches. The following items of survival equipment shall be supplied by the Government:

(1) Modified PK-2 one-man life raft, PN RF Model 3B-8664, Mod. 1, with MB-4 relief valve

(1) Chemical Desalting Kit (for 8 pints)

(3) Dye Marker packets

(2) Shark Chaser Packets

(1) Battery-Powered Survival Light for Night-time signaling use (ACR-4-E or equivalent)

(1) Signal Mirror

(1) First Aid Kit consisting of:

Gauze Compress
Gauze Bandage
Three Injectors: Two Anti-Seasickness and one pain relieving (Minimum of 1/4 grain each)
Fifteen Oxytetracycline Tablets (4 grains each)
Six motion-sickness tablets (Meclizine-3/8 grain each)
Muslin Bandage
Small cake of soap
Tube of Zinc Oxide Ointment (Approx. 2 1/2 oz.)

(1) Signal Whistle

(1) Small can Survival Rations

(1) Approximately 18 full-size waterproof matches in waterproof metal container (additional match heads shall be contained in the Survival knife handle)

3.17.3 SURVIVAL KIT - (Continued)

10 feet multi-braided nylon line (fish hooks shall be contained in Survival knife handle)

(1) Small Pocket Knife

(1) SARAH Radio Beacon with Antenna and Battery (Ultra RB-5 and RB-7)

The Survival Kit shall be packed by the contractor and shipped to the Launch Site for installation in the Capsule.

2.5.3.4

3.18 HANDLING PROVISIONS - A hoisting loop assembly in accordance with MAC Drawing No. 45-32263 shall be provided for capsule pick-up by helicopter. The loop shall be attached to the recovery compartment structural assembly by two hoist loop support fittings. The hoist loop shall be constructed of 9,000 pound capacity dacron webbing with a fiberglas plastic spring strap taped to the dacron to cause the loop to erect upon ejection of the antenna fairing. Two auxiliary hoisting fittings in accordance with MAC Drawing No. 45-32068, located at capsule station line Z123.00 shall be provided.

3.19 SUPPORT EQUIPMENT - Support equipment for Mercury capsule shall be as separately negotiated in CCP 52 Series.

3.20 PYROTECHNICS - Pyrotechnic devices in accordance with MAC Drawing No. 45-72001 (as specified in Appendix I-C, Item 11 herein) shall be provided for the following:

a. Umbilical disconnect

b. Capsule-adapter clamp ring separation

c. Tower clamp ring separation

d. Retro package release

e. Parachute deployment and disconnect

f. Antenna fairing ejection

g. Sound ranging and fixing (SOFAR)

h. Rescue antenna extension

i. Snorkel valve actuation
j. Snorkel inlet door

Pyrotechnics with the exception of snorkel valve squibs shall be installed at the launch site.

4.0 QUALIFICATION

4.1 MAC QUALIFICATION - Qualification of equipment and subsystems shall be accomplished by MAC or by subcontractors under MAC direction as defined in MAC Report 6495 and in component specification control drawings. Qualification status of parts shall be as tabulated in MAC Drawing No. 45-00003.

2.7.3 4.2 NASA QUALIFICATION - Capsules supplied by the contractor will be used in a qualification flight test program to be conducted by the NASA. The capsule and its systems shall demonstrate satisfactory performance within the framework of this specification. This qualification program will have as its final objective the accomplishment of the missions described in Paragraph 1.1.1 herein.

5.0 TESTING

2.7.4 5.1 MAC TESTING - The contractor shall undertake structural, aerodynamic, hydrodynamic, equipment, compatibility, acceptance, and evaluation tests as required in support of the capsule development program.

2.7.2 5.2 NASA TESTING - A program of research and development flight testing of the capsule will be undertaken by the NASA. This program will include full-scale flight tests of earlier capsules as described in configuration specifications bearing a dash number of this basic specification which corresponds to a capsule number.

6.0 DEFINITIONS -

NASA National Aeronautics and Space Administration

MAC McDonnell Aircraft Corporation

Normal land impact - Landing in the vicinity of the launching pad at Cape Canaveral. This local terrain shall be studied so that the soil characteristics used in landing calculations will represent conservative values for a large percentage of the possibilities. Wind drift and parachute swing angles used will be based on probability studies.

APPENDIX I-A

GOVERNMENT FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

Item	Qty.	Nomenclature	Weight
*1		Survival Equipment as Follows: (See Paragraph 3.17.3)	
1.1	1	Modified PK-2 One-Man Life Raft, PN RF Model 3B-8664, Mod. 1, with MB-4 relief valve	
1.2	1	Chemical Desalting Kit (for 8 pints)	
1.3	2	Shark Chaser Packets	
1.4	3	Dye Marker Packets	
1.5	1	Battery-Powered Survival Light for Nighttime Signaling Use (ACR-4-E or Equivalent)	
1.6	1	Signal Mirror	
1.7	1	First Aid Kit consisting of:	
1.7.1	As Req.	Gauze Compress	
1.7.2	As Req.	Gauze Bandage	
1.7.3	3	Injectors: Two Anti-seasickness and One Pain Relieving (Minimum of 1/4 grain each)	
1.7.4	15	Oxytetracycline Tablets (4 grains each)	
1.7.5	6	Motion-Sickness Tablets (Meclizine - 3/8 grain each)	
1.7.6	As Req.	Muslin Bandage	
1.7.7	1	Small Cake of Soap	
1.7.8	1	Tube of Zinc Oxide Ointment (Approx. 2-1/2 oz.)	
1.8	1	Signal Whistle	
1.9	1	Small Can Survival Rations	
1.10	18	Full-Size Waterproof Matches in Waterproof Metal Container (Additional match heads shall be contained in the survival knife handle)	
1.11	10 ft.	Multibraided Nylon Line (Fish hooks shall be contained in survival knife handle)	
1.12	1	Small Pocket Knife	
1.13	1	SARAH Radio Beacon with Antenna and Battery (Ultra RB-5 and RB-7)	

* The Survival Kit shall be packed by the contractor and shipped to the launch site for installation in the capsule.

APPENDIX I-A

GOVERNMENT FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

Item	Qty.	Nomenclature	Weight
2		Food, Low Residue	1.70
3		Deleted	
4	4	Film Pack, Cosmic Ray (See Paragraph 3.15.3)	.30
5		Deleted	
6		Connectors, Pressure Suit, Consisting of:	
6.1	1	Suit Inlet Hose	.70
6.2	1	Suit Outlet Hose	1.10
6.3		Deleted	
6.4	2	Instrumentation Patch, 16-Terminal (1 Inside, 1 Outside)	.08
7	1	Face Piece Seal Bottle, B. F. Goodrich P/N 3P1056, Including:	
7.1		1 - Bottle	
7.2		1 - Reducer	
7.3		1 - Hose	
8	1	Flashlight with Batteries Size C-Cell (See Paragraph 3.8.5.2)	
9	1	Knife, Survival (See Paragraph 3.8.5.1)	
10	1	Container, Food, 2" X 5" X 6" Max. (Army Quartermaster Corps. per MAC Drawing No. 45-019717)	

APPENDIX I-B

GOVERNMENT FURNISHED EQUIPMENT - GOVERNMENT INSTALLED

Not Used

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Mfg. No.
1		General Assembly, Mercury Including:	45-00001-37	-----
1.1	1	Structural Assembly, Pylon	45-31001-303	-----
1.2	1	Antenna Assembly, Communi-cations	45-31003-305	-----
1.3	1	Capsule Assembly	45-32000-313	-----
1.3.1	1	Structural Assembly, Capsule	45-32001-303	-----
1.3.1.1	1	Structural Assembly Conical Section	45-32002-303	-----
1.3.1.1.1	1	Window Assembly, Capsule Inner (Forward Viewing)	45-35035-301	-----
1.3.1.2	1	Structural Assembly Cylindrical Section	45-32003-301	-----
1.3.2	1	Shingle Installation, Capsule	45-32245-301	-----
1.3.3	1	Insulation Installation	45-32038-307	-----
1.3.4	1	Heat Shield Assembly Including:	45-32052-303-16	-----
1.3.4.1	48	Spacer	45-32052-7	-----
1.3.4.2	1	Heat Shield	45-32052-11	
1.3.4.3	48	Heli-Coil Insert	-----	Heli-Coil Corp. 3591-4CN-375

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
1.3.4.4	219	Helical Coil Insert	-----	NAS 1222-3E
1.3.4.5	6	Shim	45-32052-19	-----
1.3.5	1	Door Assembly, Periscope	45-32091-1	-----
1.3.6	1	Pin, Periscope Door Hinge	45-32093-3	-----
1.3.7	1	Window Assembly, Capsule Outer	45-35030-1	-----
1.3.8	1	Impact Cushion Installation	45-32300-5	-----
1.3.9	1	Antenna, HF Rescue, 16 Ft. Whip	-----	-----
1.3.10	1	Antenna, Aux. UHF Rescue	-----	-----
1.4	1	Adapter Assembly, Atlas	45-33002-303	-----
1.5	1	System Installation, Recovery (See Item 10)	45-41001-319	-----
1.6	1	Rocket Installation, Retrograde (See Item 2)	45-50001-1	-----
1.6.1	6	Spacer, Adjusting Retro	45-50014-5	-----
1.6.2	3	Retention Assembly, Retrograde Package	45-72030-301	-----
1.7	1	Rocket Installation, Escape (See Item 2)	45-51001-303	-----
1.7.1	1	Escape Rocket Structural Assembly	45-51002-305	-----
1.7.1.1	1	Ballast, Nose	45-51010-301	-----

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.7.1.2	2	Fairing, Rocket Junction Box Lug	45-51024-1	-----
1.7.1.3	2	Fairing, Escape Rocket, Tunnel Wiring	45-51023-1	-----
1.8	1	System Installation, Manual Controls	45-61001-301	-----
1.8.1	1	H_2O_2 System Installation	45-61075-301	-----
1.9	1	System Installation, Reaction Controls (See Item 6)	45-62001-27	-----
1.9.1	1	Pressurization Installation, Reaction Controls, Manual and Automatic	45-62010-17	-----
1.9.2	1	Pressurization Installation, Reaction Controls, Manual and Automatic	45-62010-17	-----
1.9.3	1	Fuel Installation, Reaction Control	45-62040-303	-----
1.9.4	1	Fuel Installation, Reaction Control	45-62040-305	-----
1.9.5	1	Installation, Min. "K" Insulation, Reaction Controls	45-62049-5	-----
1.9.6	1	Installation, Min. "K" Insulation, Reaction Controls	45-62049-7	-----
1.10	1	System Installation, Pyro-technics (See Item 11)	45-72001-19	-----

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Mfg. No.
1.10.1	1	Installation Conical Fairing Pylon to Capsule	45-72045-1	-----
1.10.1.1	1	Fairing Assembly, Pylon to Capsule, Conical	45-72043-1	-----
1.10.2	1	Clamp Ring, Capsule-Adapter	45-72010-301	-----
1.10.3	1	Installation, Antenna Fairing Ejector	45-72020-303	-----
1.10.4	1	Installation, Retaining Ring, Pylon to Capsule	45-72040-1	-----
1.10.5	1	Installation, Emergency Controls (Manual)	45-72050-301	-----
1.11	1	Electrical Installation, Escape Rocket	45-77000-1	-----
1.12	1	Electrical Installation, Pylon	45-77001-301	-----
1.13	1	Electrical Installation, Antenna Fairing	45-77002-1	-----
1.14	1	Electrical Installation, Midsection	45-78003-305	-----
1.15	1	Electrical Installation, Heat Shield	45-78001-307	-----
1.16	1	Electrical Installation, Retrorocket	45-78002-1	-----
1.17	1	Electrical Installation, Adapter - Atlas	45-79001-1	-----

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.18	1	Equipment Installation (See Items 3, 4, 5, 6, 7, 8 and 9)	45-80018-1	-----
1.18.1	1	Equipment Installation, R.H. Console	45-81002-309	-----
1.18.2	1	Main Instrument Panel	45-81100-309	-----
1.18.3	1	Panel Assembly, L. H. Console	45-81110-303	-----
1.18.4	1	Installation, Window Pole and Flashlight	45-81098-1	-----
1.18.5	1	Cover and Filter Assembly, Window	45-86005-301	-----
1.18.5.1	1	Cover Assembly	45-86006-1	-----
1.18.5.2	1	Cover Assembly	45-86006-2	-----
1.18.5.3	1	Filter Assembly, Forward Looking Window	45-86007-1	-----
1.18.5.4	1	Filter Assembly, Forward Looking Window	45-86007-2	-----
1.18.5.5	1	Mirror Assembly, Extended Viewing	45-86028-1	-----
1.18.5.6	1	Filter Assembly, Polaroid, Image Suppression	45-86034-1	-----
1.18.6	1	Installation, Face Lens Seal Bottle	45-82070-1	-----

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.18.7	1	Installation, Astronaut's Knife	45-81102-1	-----
1.18.8	1	Kit Assembly, Survival	45-81029-303	-----
1.18.9	2	Container, Water	45-81708-5	AMF: 9588-A
1.18.10	1	Installation, Harness, Reel and Release Linkage	45-82013-301	-----
1.18.11	1	Mirror Assembly, Clock	45-86017-1	-----
1.18.12	1	Navigational Aid Kit	45-81089-1	-----
1.18.13	1	Binder Assembly, Navigational Aid Kit	45-81087-3	-----
1.18.14	1	Tank Assembly, Condensate	45-83076	-----
1.18.15	1	Crushable Support Assembly, Pilot Seat	45-82001-1-19*	-----
1.18.16	1	Crushable Support Assembly, Pilot Seat	45-82057-1-19*	-----

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

	Astronaut	Seat Inst - Astronaut 45-82003*	R.H. Arm Rest 45-82003*	L.H. Arm Rest 45-82003*	Seat Ass'y Astronaut Contoured 45-82000*	Head Ass'y. 45-82000*	Back Ass'y. 45-82000*	Leg Restraint Ass'y. 45-82002*
1.18.17	Carpenter	-1	-33	-17	-1	-17	-33	-1
1.18.18	Cooper	-3	-35	-19	-3	-19	-35	-19
1.18.19	Glen	-5	-37	-21	-5	-21	-37	-21
1.18.20	Grissom	-7	-39	-23	-7	-23	-39	-23
1.18.21	Shirra	-9	-41	-25	-9	-25	-41	-25
1.18.22	Shepard	-11	-43	-27	-11	-27	-43	-27
1.18.23	Slayton	-13	-45	-29	-13	-29	-45	-29

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ROCKET INSTALLATIONS

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Mfg. No.
2		Capsule Rocket Installations		
2.1	3	Rocket Assembly, Retrograde, consisting of:	45-50700-13	-----
2.1.1	1	Rocket, Retrograde	45-50700-3	Thiokol: TE-316
2.1.1.1	1	Pressure Switch	-----	-----
2.1.2	1	Heater Assembly	45-50702-11	COX: 6005-11
2.1.3	1	Heater	45-50702-7	COX: 6005-7
2.1.4	1	Temperature Control Unit	45-50702-13	-----
2.2	3	Rocket, Posigrade	45-50701-3	Atlantic Research: D20763
2.3	1	Rocket, Escape System	45-51700-3	Grand-Central: 477-80100
2.4	1	Rocket, Pylon Jettison	45-51701-3	Atlantic-Research: E-20189

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
3		Airborne Equipment, Consisting of:		
3.1	1	Longitudinal Accelerometer (See Paragraph 3.8.9.3)	45-81702-11	Burton: 2062C
3.2	1	Altimeter	45-81704-5	Kollsman Instruments: A 33841-10-001
3.3	1	Satellite Clock (See Paragraph 3.8.9.1)	45-81710-3	Walthams: 400087
3.4	1	D.C. Voltmeter	45-81716-3	Weston Instrument: 183537
3.5	1	D.C. Ammeter	45-81717-3	Weston Instrument: 183538
3.6	1	A.C. Voltmeter	45-81718-3	Weston Instrument: 183539
3.7	1	Indicator, Auto-Man Fuel	45-81719-9	Weston Instrument: 185377
3.8	1	Transducer (Pitch)	45-81721-5	Minneapolis-Honeywell GG 134A-8
3.9	1	Transducer (Roll)	45-81721-19	Minneapolis-Honeywell GG 134A-7

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
3.10	1	Transducer (YAW)	45-81721-9	Minneapolis-Honeywell GG 134A-9
3.11	1	Indicator, Angular Rate and Attitude (See Paragraph 3.8.9.2)	45-81721-23	Minneapolis-Honeywell JG 282A-3
3.12	1	Earth Path Indicator (See Paragraph 3.8.9.6)	45-81722-5	Minneapolis-Honeywell DJG 280A-1 Series A5
3.13	1	Indicator, Partial Pressure	45-81724-3	Weston Instrument: 185916
3.14	1	Indicator, (Dual) O_2 Quantity	45-83706-7	Weston Instrument: 185378
3.15	1	Indicator, Cabin Pressure	45-83707-3	Kollsman Instrument: A 33681-10-001
3.16	1	Indicator, Cabin Air Temperature	45-83708-5	Weston Instrument: 183513
3.17	1	Indicator, Humidity	45-83712-5	Minneapolis-Honeywell JG 284A-1 (series 2)

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
3.18	1	Periscope (See Paragraph 3.16.1)	45-86701-19	Perkin-Elmer 539-0109-1
3.19	2	Horizon Scanner (See Paragraph 3.10.2)	45-87702-5	Barnes Engineering: 13-130A
3.20	1	Indicator, Coolant Quantity	45-83701-5	Weston Instrument: 185379
3.21	1	Rate of Descent	45-81723-3	Pioneer-Central: 1652-15A-B15-1
3.22	1	Indicator, Partial Pressure	45-81725-3	Weston Instrument: 185917

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
4		Electrical Equipment, Consisting of:		
4.1	1	Diode Panel Assembly, Power System Control	45-78012-311	---
4.2	1	Relay Panel Assembly, Power System Control	45-78081-333	---
4.3	1	Relay Panel Assembly, Power System Control	45-78081-337	---
4.4	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-307	---
4.5	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-325	---
4.6	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-327	---
4.7	1	Relay Panel Assembly, Retrograde Sequential	45-78085-345	---
4.8	1	Relay Panel Assembly, Recovery Sequential	45-78086-349	---
4.9	1	Relay Panel Assembly, Recovery Sequential	45-78086-353	---
4.10	1	Relay Panel Assembly, Communication and Periscope	45-78089-313	---
4.11	1	Relay Panel Assembly, ASCS System	45-78090-327	---

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.12	1	Relay Panel Assembly, ASCS System	45-78090-333	---
4.13	1	Relay Panel Assembly, Instrumentation Control System	45-78092-307	---
4.14	3	Thermostat Assembly, Retro-grade Rockets	45-79705-11	United Controls: 1310-1
4.15	1	Battery (3000 Watt-Hour)	45-79707-21	Eagle Pitcher: MAR-4027-C
4.16	5	Battery (1500 Watt-Hour)	45-79707-19	Eagle Pitcher: MAR-4028-B
4.17	2	Static Inverter (250 VA)	45-79709-1	Interelectronics: 28T15A40HA-2
4.18	1	Static Inverter (150 VA)	45-79709-3	Interelectronics: 28T15A40GB
4.19	2	Filter Assembly	45-79709-7	Interelectronics: 28FA30GHA-2
4.20	61	Power and Control Relay	45-79712-2	Filtors: P26A1H6A9
4.21	39	Power and Control Relay	45-79712-8	Potter-Brumfield: SL4080-1
4.22	4	Power and Control Relay	45-79712-12	Leach: 9227-5369
4.23	1	Power and Control Relay	45-79712-15	Leach: 9226-5368

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
4.24	7	Power and Control Relay	45-79712-16	Leach: 9224-5367
4.25	6	Power and Control Relay	45-79712-33	Filtors: 26SR18F
4.26	12	Power and Control Relay	45-79712-34	Filtors: LI26E18
4.27	12	Power and Control Relay	45-79712-19	Leach: 9229-5371
4.28	13	Power and Control Relay	45-79712-21	Leach: 9220-5366
4.29	3	Power and Control Relay	45-79712-22	Leach: 9228-5370
4.30	3	Power and Control Relay	45-79712-23	Leach: 9223-5375
4.31	1	Power and Control Relay	45-79712-26	Leach: 9274-5300
4.32	2	Power and Control Relay	45-79712-27	Leach: 9274-5377
4.33	2	Power and Control Relay	45-79712-28	Leach: 9229-5372
4.34	2	Power and Control Relay	45-79712-32	Leach: 9220-5378
4.35	1	Limit Switch	45-79713-13	Electro-Snap H11-60

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.36	3	Limit Switch	45-79713-15	Electro-Snap H11-61
4.37	6	Push Button	45-79713-23	Haydon Switch 61375
4.38	5	Guard	45-79713-25	Electro-Snap 42-041
4.39	12	Limit Switch	45-79713-29	Electro-Snap: KX5-4-1
4.40	12	Actuator	45-79713-31	C9618-4
4.41	4	Limit Switch	45-79713-77	Haydon Switch: 61519
4.42	1	Limit Switch	45-79713-43	Electro-Snap: H11-87
4.43	2	Limit Switch	45-79713-45	Electro-Snap: H11-88
4.44	1	Limit Switch	45-79713-47	Electro-Snap: H11-90
4.45	1	Limit Switch	45-79713-49	Electro-Snap: H11-49-1
4.46	4	Limit Switch	45-79713-51	Electro-Snap: H11-50-1
4.47	2	Limit Switch	45-79713-53	Electro-Snap: H11-51-1
4.48	4	Limit Switch	45-79713-55	Electro-Snap: H11-52-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.49	7	Relay - Time Delay 2 Seconds	45-79715-1	Wheaton: E371-A
4.50	3	Relay - Time Delay 5 Seconds	45-79715-7	Wheaton: E371-D
4.51	1	Relay - Time Delay 15 Seconds	45-79715-13	Wheaton: E371-F
4.52	2	Relay - Time Delay 20 Seconds	45-79715-15	Wheaton: E371-G
4.53	3	Relay - Time Delay 30 Seconds	45-79715-17	Wheaton: E371-H
4.54	1	Relay - Time Delay 300 Seconds	45-79715-29	Wheaton: E376
4.55	1	Relay - Time Delay 30 Seconds	45-79715-33	Wheaton: E372-A
4.56	2	Relay - Time Delay 30 Seconds	45-79715-37	Wheaton: E372-E
4.57	3	Relay - Time Delay 60 Seconds	45-79715-39	Wheaton: E372-F
4.58	1	Relay - Time Delay 150 Seconds	45-79715-43	Wheaton: E375-D
4.59	2	Relay - Time Delay 600 Seconds	45-79715-45	Wheaton: E409
4.60	2	Relay - Time Delay 5 Seconds	45-79715-51	Wheaton: E372-G

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.61	2	Relay - Time Delay 10 Seconds	45-79715-53	Wheaton: E372H
4.62	2	Relay - Time Delay 1 Second	45-79715-55	Wheaton: E372J
4.63	4	Relay - Time Delay 12 Seconds	45-79715-57	Wheaton: E372K
4.64	2	Relay - Time Delay	45-79715-61	Wheaton: E174
4.65	2	Relay - Time Delay 2 Seconds	45-79715-63	Wheaton: E372R
4.66	1	Relay - Time Delay 240 and 480 Seconds	45-79715-65	Wheaton: E494C
4.67		Deleted		
4.68	1	Telelight Assembly Consisting of:	45-79720-141	Grimes: 33340-141-327
4.68.1	1	Clip	45-79720-45	Grimes: 33340-45

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.68.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.68.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.68.4	1	Nomenclature Cap (Tower Jett.)	45-79720-143	Grimes: 33340-143
4.69	1	Telelight Assembly Consisting of:	45-79720-145	Grimes: 33340-145-327
4.69.1	1	Clip	45-79720-45	Grimes: 33340-45
4.69.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.69.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.69.4	1	Nomenclature Cap (Capsule Sep.)	45-79720-147	Grimes: 33340-147
4.70	1	Telelight Assembly Consisting of:	45-79720-149	Grimes: 33340-149-327
4.70.1	1	Clip	45-79720-45	Grimes: 33340-45
4.70.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.70.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.70.4	1	Nomenclature Cap Retro Seq.	45-79720-151	Grimes: 33340-151
4.71	1	Telelight Assembly, Consisting of:	45-79720-153	Grimes: 33340-153-327
4.71.1	1	Clip	45-79720-45	Grimes: 33340-45
4.71.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.71.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.71.4	1	Nomenclature Cap (Retro Att.)	45-79720-155	Grimes: 33340-155
4.72	1	Telelight Assembly Consisting Of:	45-79720-157	Grimes 33340-157-327
4.72.1	1	Clip	45-79720-45	Grimes: 33340-45
4.72.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.72.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.72.4	1	Nomenclature Cap (Fire Retro)	45-79720-159	Grimes: 33340-159
4.73	1	Telelight Assembly Consisting of:	45-79720-161	Grimes: 33340-161-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC. No.	IDENTIFICATION Mfg. No.
4.73.1	1	Clip	45-79720-45	Grimes: 33340-45
4.73.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.73.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.73.4	1	Nomenclature Cap (Jett Retro)	45-79720-163	Grimes: 33340-163
4.74	1	Telelight Assembly Consisting of:	45-79720-165	Grimes: 33340-165-327
4.74.1	1	Clip	45-79720-45	Grimes: 33340-45
4.74.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.74.3	1	Nomenclature Cap Retract Scope	45-79720-167	Grimes: 33340-167
4.75	1	Telelight Assembly Consisting of:	45-79720-169	Grimes: 33340-169-327
4.75.1	1	Clip	45-79720-45	Grimes: 33340-45
4.75.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.75.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.75.4	1	Nomenclature Cap (0.05g Switch)	45-79720-171	Grimes: 33340-171
4.76	1	Telelight Assembly Consisting of:	45-79720-173	Grimes: 33340-173-327
4.76.1	1	Clip	45-79720-45	Grimes: 33340-45
4.76.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.76.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.76.4	1	Nomenclature Cap (Main)	45-79720-175	Grimes: 33340-175
4.77	2	Telelight Assembly Consisting of:	45-79720-177	Grimes: 33340-177-327
4.77.1	1	Clip	45-79720-45	Grimes: 33340-45
4.77.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.77.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.77.4	1	Nomenclature Cap (Rescue)	45-79720-179	Grimes: 33340-179
4.78	1	Telelight Assembly Consisting of:	45-79720-181	Grimes: 33340-181-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.78.1	1	Clip	45-79720-101	Grimes: 33340-101
4.78.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.78.3	1	Nomenclature Cap (Standby - DC Auto.)	45-79720-183	Grimes: 33340-183
4.79	1	Telelight Assembly Consisting of:	45-79720-185	Grimes: 33340-185-327
4.79.1	1	Clip	45-79720-101	Grimes: 33340-101
4.79.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.79.3	1	Nomenclature Cap (Standby - A.C. Auto)	45-79720-187	Grimes: 33340-187
4.80	1	Telelight Assembly Consisting of:	45-79720-189	Grimes: 33340-189-327
4.80.1	1	Clip	45-79720-101	Grimes: 33340-101
4.80.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.80.3	1	Nomenclature Cap (Cabin Press)	45-79720-191	Grimes: 33340-191
4.81	1	Telelight Assembly Consisting of:	45-79720-193	Grimes: 33340-193-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.81.1	1	Clip	45-79720-101	Grimes: 33340-101
4.81.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.81.3	1	Nomenclature Cap (O_2 Quan.)	45-79720-195	Grimes: 33340-195
4.82	1	Telelight Assembly Consisting of:	45-79720-197	Grimes: 33340-197-327
4.82.1	1	Clip	45-79720-101	Grimes: 33340-101
4.82.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.82.3	1	Nomenclature Cap (O_2 Emer)	45-79720-199	Grimes: 33340-199
4.83	1	Telelight Assembly Consisting of:	45-79720-201	Grimes: 33340-201-327
4.83.1	1	Clip	45-79720-101	Grimes: 33340-101
4.83.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.83.3	1	Nomenclature Cap (O_2 Press)	45-79720-203	Grimes: 33340-203
4.84	1	Telelight Assembly Consisting of:	45-79720-205	Grimes: 33340-205-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.84.1	1	Clip	45-79720-101	Grimes: 33340-101
4.84.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.84.3	1	Nomenclature Cap (CO_2 Press)	45-79720-207	Grimes: 33340-207
4.85	4	Telelight Assembly	45-79720-209	Grimes: 33340-209-327
4.85.1	1	Clip	45-79720-101	Grimes: 33340-101
4.85.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.85.3	1	Nomenclature Cap (Excess Suit H_2O)	45-79720-211	Grimes: 33340-211
4.86	1	Telelight Assembly	45-79720-213	Grimes: 33340-213-327
4.86.1	1	Clip	45-79720-101	Grimes: 33340-101
4.86.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.86.3	1	Nomenclature Cap (Excess Cabin H_2O)	45-79720-215	Grimes: 33340-215
4.87	1	Telelight Assembly	45-79720-217	Grimes: 33340-217-327

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CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.87.1	1	Clip	45-79720-101	Grimes: 33340-101
4.87.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.87.3	1	Nomenclature Cap (Fuel Quan.)	45-79720-219	Grimes: 33340-219
4.88	1	Telelight Assembly	45-79720-221	Grimes: 33340-221-327
4.88.1	1	Clip	45-79720-101	Grimes: 33340-101
4.88.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.88.3	1	Nomenclature Cap (Retro Warn)	45-79720-223	Grimes: 33340-223
4.89	1	Telelight Assembly	45-79720-225	Grimes: 33340-225-327
4.89.1	1	Clip	45-79720-101	Grimes: 33340-101
4.89.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.89.3	1	Nomenclature Cap (Retro Reset)	45-79720-227	Grimes: 33340-227
4.90		Deleted		

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APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.91	1	Light Assembly (Abort)	45-79720-237	Grimes: 34160-237-313
4.92	1	Telelight Assembly	45-79720-241	Grimes: 33340-241-327
4.92.1	1	Clip	45-79720-45	Grimes: 33340-45
4.92.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.92.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.92.4	1	Nomenclature Cap (Landing Bag)	45-79720-243	Grimes: 33340-243
4.93	2	Plug, Tower Elec. Disconnect	45-79722-1	Cannon: 39884
4.94	2	Receptacle, Tower Elec. Disconnect	45-79722-3	Cannon: 39885
4.95	2	Cover, Tower Elec. Disconnect	45-79722-5	Cannon: 39886

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.96	1	Receptacle, Umbilical Disconnect Assembly	45-79723-1	Cannon: GMA017072-33
4.97	50	Fuse (5 Amp)	45-79727-3	Harris: 34020-5
4.98	8	Fuse Block Assembly Consisting of:	45-79727-39	Harris: 33000-39
4.98.1	12	Fuse (5 Amp)	45-79727-3	Harris: 34020-5
4.98.2	1	Fuse Block Assembly Shell	45-79727-61	Harris: 33000-61
4.99	8 1	Fuse Holder Cover, Each with Angle	45-79727-7 45-79727-67	Harris: 33000-7 ---
4.100	8 1	Fuse Holder Cover, Each with Angle	45-79727-9 45-79727-67	Harris: 33000-9 ---
4.101	6	Fuse (10 Amp)	45-79727-11	Harris: 34020-10
4.102	1	Fuse Block Assembly, Consisting of:	45-79727-47	Harris: 33000-47
4.102.1	8	Fuse (10 Amp)	45-79727-11	Harris: 34020-10
4.102.2	4	Fuse (25 Amp)	45-79727-13	Harris: 34020-25
4.102.3	1	Fuse Block Assembly Shell	45-79727-63	Harris: 33000-63
4.103	1 1	Fuse Holder Cover With Angle	45-79727-17 45-79727-67	Harris: 33000-17 ---
4.104	1 1	Fuse Holder Cover, With Angle	45-79727-19 45-79727-67	Harris: 33000-19 ---
4.105	3	Fuse Block Assembly Consisting of:	45-79727-55	Harris: 33000-55

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.105.1	4	Fuse (5 Amp)	45-79727-3	Harris: 34020-5
4.105.2	8	Fuse (10 Amp)	45-79727-11	Harris: 34020-10
4.105.3	1	Fuse Block Assembly Shell	45-79727-65	Harris: 33000-65
4.106	3 1	Fuse Holder Cover, Each With Angle	45-79727-31 45-79727-67	Harris: 33000-31 ---
4.107	3 1	Fuse Holder Cover, Each with Angle	45-79727-33 45-79727-67	Harris: 33000-33
4.108	31	Switch	45-79729-79	Harris: 34000-7
4.109	1	Switch - 8 Position Rotary	45-79731-1	Harris: 32000-1
4.110	6	Toggle Switch	45-79732-1	Cutler-Hammer: 8906K983
4.111	21	Toggle Switch	45-79732-13	Cutler-Hammer: 8906K984
4.112	2	Toggle Switch	45-79732-15	Cutler-Hammer: 8906K985
4.113	2	Toggle Switch	45-79732-25	Cutler-Hammer 8906K986
4.114	1	Plug Assembly-Antenna	45-79736-1	Cannon: 22037-98
4.115	1	Receptacle Assembly - Antenna	45-79736-3	Cannon: 22037-99

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.116	5	Plug Assembly - Retrograde and Adapter	45-79736-9	Cannon: 22036-96
4.117	5	Receptacle Assembly - Retrograde and Adapter	45-79736-11	Cannon: 22037-97
4.118	1	Floodlight	45-79738-3	Grimes: 43315-A1-5004WW
4.119	1	Floodlight	45-79738-4	Grimes: 43315-A2-5004WW
4.120	1	Panel Assembly, L.H. Switch	45-81014-301	---
4.121	1	Flashing Recovery Light	45-86702-3	ACR Electronics: ACR 113-M
4.122	1	Maximum Altitude Sensor	45-87708-9	Donner-Scientific: 7005C
4.123	1	Thrust Cutoff Sensor	45-87709-5	Donner-Scientific: 4403-2-300-020

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AUTOMATIC STABILIZATION AND CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	[illegible] No.
5	1	Automatic Stabilization and Control System, Consisting of:	45-87700-301	YG351A-1
5.1	1	Attitude Gyro (Vertical)	45-87700-3	GG53E-3
5.2	1	Attitude Gyro (Directional)	45-87700-5	GG53E-4
5.3	1	Rate Gyro (Pitch)	45-87700-7	GG79A-10
5.4	1	Rate Gyro (Roll)	45-87700-9	GG79A-11
5.5	1	Rate Gyro (Yaw)	45-87700-11	GG79A-12
5.6	1	Acceleration Switch	45-87700-15	GG118A-1
5.7	1	Rate Damper	45-87700-17	BG171A-1
5.8	1	Calibrator	45-87700-23	BG161A-6

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
6	1	Reaction Control System, Consisting of:	45-61700-24	Bell Aircraft
6.1	5	Valve, Check (5/16)	45-61700-51	8060-472-035-1
6.2	1	Union Similar To (AN 832-6D)	45-61700-53	8060-475-020-6
6.3	3	TEE Similar to (AN 824-4D)	45-61700-54	8060-475-021-4
6.4	2	Elbow Similar To (AN 833-6D)	45-61700-55	8060-475-023-6
6.5	4	Union Similar To (AN 815-4D)	45-61700-56	8060-475-022-4
6.6	7	Union Similar To (AN 815-5D)	45-61700-57	8060-475-022-5
6.7	1	Union Similar To (AN 815-6D)	45-61700-58	8060-475-022-6
6.8	1	Valve, Solenoid Assy., 6 lb.	45-61700-59	8060-475-011-1
6.9	3	Valve, Solenoid, 24 lb.	45-61700-61	8060-472-033-7
6.10	1	Valve, Solenoid, 24 lb.	45-61700-62	8060-472-033-9
6.11	4	T/C Assy., Pitch and Yaw, 4-24 lbs., Man.	45-61700-77	8060-470-115-1
6.12	1	T/C Assy., Roll, Lower, 1-6 lbs., Man.	45-61700-79	8060-470-116-1
6.13	1	T/C Assy., Roll, Upper, 1-6 lbs., Man.	45-61700-80	8060-470-116-2
6.14	1	T/C Assy., Roll, Lower, 1-6 lbs., Auto	45-61700-81	8060-475-013-5

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
6.15	1	T/C Assy., Roll, Upper, 1-6 lbs., Auto	45-61700-82	8060-475-013-6
6.16	4	T/C Assy., Pitch and Yaw, 24 lb. Auto	45-61700-83	8060-470-112-5
6.17	4	T/C Assy. Pitch and Yaw, 1 lb. Auto.	45-61700-85	8060-470-113-5
6.18	1	Tank Assy. Auto	45-61700-89	8060-471-001-7
6.19	1	Tank Assy. Manual	45-61700-91	8060-471-010-7
6.20	1	TEE Similar To (AN 834-6D)	45-61700-1021	8060-475-019-6
6.21	1	45° Elbow Similar To (AN 837-6D)	45-61700-1022	8060-475-024-6
6.22	1	90° Elbow Similar To (AN 821-6D)	45-61700-1023	8060-475-025-6
6.23	2	Disconnect, Fill Vent	45-61700-1037	8060-472-021-3
6.24	2	Valve, Relief (3/8")	45-61700-1041	8060-472-122-1
6.25	3	Valve, Manual Shut-off	45-61700-1045	8060-472-024-3
6.26	1	Valve, Selector (RSCS)	45-61700-1047	8060-472-036-3
6.27	1	Valve, Throttle, 1-6 lbs. (1/4")	45-61700-1049	8060-472-038-5
6.28	2	Valve, Throttle, 4-24 lbs.	45-61700-1051	8060-472-039-3
6.29	1	Tube Assy., H_2O_2	45-61700-126	8060-475-106-11

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CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
6.30	1	Tube Assy., H_2O_2	45-61700-127	8060-475-107-11
6.31	1	Tube Assy., H_2O_2	45-61700-128	8060-475-105-11
6.32	1	Tube Assy., H_2O_2	45-61700-129	8060-475-112-11
6.33	1	Tube Assy., H_2O_2	45-61700-130	8060-475-113-11
6.34	1	Tube Assy., H_2O_2	45-61700-131	8060-475-114-11
6.35	1	Tube Assy., H_2O_2	45-61700-132	8060-475-115-11
6.36	4	Tube Assy., H_2O_2	45-61700-133	8060-475-131-11
6.37	1	Tube Assy., H_2O_2	45-61700-134	8060-475-120-11
6.38	1	Tube Assy., H_2O_2	45-61700-135	8060-475-121-11
6.39	1	Tube Assy., H_2O_2	45-61700-136	8060-475-128-11
6.40	1	Tube Assy., H_2O_2	45-61700-137	8060-475-129-11
6.41	1	Tube Assy., H_2O_2	45-61700-138	8060-475-123-11
6.42	1	Tube Assy., H_2O_2	45-61700-141	8060-475-137-11
6.43	1	Tube Assy., H_2O_2	45-61700-221	8060-475-221-11
6.44	1	Tube Assy., H_2O_2	45-61700-222	8060-475-238-11
6.45	1	Tube Assy., H_2O_2	45-61700-223	8060-475-223-11
6.46	1	Tube Assy., H_2O_2	45-61700-224	8060-475-239-11
6.47	4	Tube Assy., H_2O_2	45-61700-225	8060-475-232-11

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CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
6.48	1	Tube Assy., H_2O_2	45-61700-226	8060-475-240-11
6.49	1	Tube Assy., H_2O_2	45-61700-227	8060-475-227-11
6.50	1	Tube Assy., H_2O_2	45-61700-228	8060-475-228-11
6.51	1	Tube Assy., H_2O_2	45-61700-229	8060-475-229-11
6.52	1	Tube Assy., H_2O_2	45-61700-230	8060-475-230-11
6.53	1	Tube Assy., H_2O_2	45-61700-231	8060-475-231-11
6.54	1	Tube Assy., H_2O_2	45-61700-232	8060-475-202-11
6.55	1	Tube Assy., H_2O_2	45-61700-233	8060-475-206-11
6.56	1	Tube Assy., H_2O_2	45-61700-234	8060-475-213-11
6.57	1	Tube Assy., H_2O_2	45-61700-235	8060-475-214-11
6.58	1	Tube Assy., H_2O_2	45-61700-236	8060-475-219-11
6.59	1	Tube Assy., H_2O_2	45-61700-237	8060-475-237-11
6.60	1	Tube Assy., H_2O_2	45-61700-238	8060-475-218-11
6.61	2	Filter	45-61700-407	8060-472-004-1
6.62	2	Valve, Check	45-61700-417	8060-472-010-1
6.63	2	TEE Similar To (MS24402D4)	45-61700-421	8060-475-026-4
6.64	2	Elbow Similar To (MS24394D4)	45-61700-423	8060-475-028-4

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
6.65	1	TEE Similar To (MS24395D4)	45-61700-425	
6.66	1	TEE Similar To (MS24390D4)	45-61700-427	
6.67	1	Tube Assy., H_e	45-61700-430	
6.68	1	Tube Assy., H_e	45-61700-431	
6.69	2	Tube Assy., H_e	45-61700-432	
6.70	1	Tube Assy., H_e	45-61700-457	8060-475-457-1
6.71	1	Tube Assy., H_e	45-61700-458	8060-475-458-1
6.72	1	Tube Assy., H_e	45-61700-459	8060-475-459-1
6.73	1	Tube Assy., H_e	45-61700-461	8060-475-461-1
6.74	1	Tube Assy., H_e	45-61700-464	8060-475-464-1
6.75	1	Tube Assy., H_e	45-61700-450	8060-475-450-1
6.76	1	Tube Assy., H_e	45-61700-472	8060-475-442-11
6.77	1	Tube Assy., H_e	45-61700-473	8060-475-443-11
6.78	1	Tube Assy., H_e	45-61700-474	8060-475-444-11
6.79	1	Tube Assy., H_e	45-61700-475	8060-475-445-11
6.80	1	Tube Assy., H_e	45-61700-476	8060-475-446-11
6.81	1	Tube Assy., H_e	45-61700-477	8060-475-447-11
6.82	1	Tube Assy., H_e	45-61700-478	8060-475-451-11

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CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
6.83	1	Tube Assy., H_e	45-61700-479	8060-475-453-11
6.84	1	Tube Assy., H_e	45-61700-480	8060-475-454-11
6.85	1	Tube Assy., H_e	45-61700-481	8060-475-463-11
6.86	1	Valve Jettison (0.55 To 0.75 OHMS)	45-61700-482	8060-472-091-1
6.87	1	Tube Assy., H_e	45-61700-484	
6.88	1	Valve, Manual, Shutoff (Regulator)	45-61700-485	8060-472-001-9
6.89	1	Transducer (PF)	45-61700-489	8060-472-014-5
6.90	1	Transducer (PF)	45-61700-490	8060-472-014-7
6.91	1	Valve, Man. Shutoff (Reg.)	45-61700-491	8060-472-001-7
6.92	2	Valve, Man., Shutoff (H_e Fill)	45-61700-492	8060-472-001-5
6.93	2	Valve, Manual, Shutoff Low	45-61700-495	8060-472-009-3
6.94	2	Bottle (H_e)	45-61700-497	8060-471-070-1
6.95	2	Valve Relief	45-61700-499	8060-472-107-1
6.96	2	Regulator Assembly	45-61700-1403	8060-472-006-9

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATION SYSTEMS

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
7		Communications System Consisting of:	45-85700-335	Collins:	
7.1	1	Transmitter-Receiver, HF Voice	45-85700-3	Collins: 522 1793 025	
7.2	1	Transmitter-Receiver, HF Rescue-Voice	45-85700-5	Collins: 522 1794 025	
7.3	2	Decoder, Command	45-85700-13	Motorola: 201 312 98C	
7.4	1	Beacon, C-Band Radar	45-85700-91	Avion: 152A300-2	R-1
7.5	1	Beacon, S-Band Radar	45-85700-93	Avion: 152A800-2	R-1
7.6	1	Panel, Control	45-85700-31	Collins: 522 1812 034	
7.7	3	Antenna, S and C-Band	45-85700-33	Melpar: R436158-1A	
7.8	1	Power Divider, C-Band	45-85700-35	Melpar: R530310-1B	
7.9	1	Isolator, Bicone	45-85700-43	Collins: 522 1963 012	
7.10	1	Antenna,. UHF Descent	45-85700-49	Collins: 522 1817 015	
7.11	2	Switch, Coaxial	45-85700-51	Transco: 1460 233A	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATION SYSTEMS

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
7.12	1	Diplexer, HF	45-85700-57	Collins: 522 1813 014	
7.13	1	Amplifier, UHF Voice Power	45-85700-61	Collins: 522 1989 015	
7.14	2	Transmitter-Receiver, UHF Voice	45-85700-63	Collins: 522 1851 025	
7.15	1	Audio Center	45-85700-65	Andrea: AC 75E	
7.16	1	Multiplexer	45-85700-71	Microphase: 7M769B-1	
7.17	1	Power Divider, S-Band	45-85700-73	Melpar: R530311-1C	R-1
7.18	1	Beacon, HF/UHF Rescue	45-85700-75	Simmonds Aero.: 311006B	
7.19	1	Transmitter, Telemetry - Low Freq.	45-85700-77	Texas Instr.: 421923-A4	
7.20	1	Transmitter, Telemetry - High Freq.	45-85700-79	Texas Instr.: 421923-B3	
7.21	2	Power Supply, Telemetry	45-85700-81	Texas Instr.: 421924-3	
7.22	1	Line Filter, Telemetry	45-85700-83	Collins: 522 2223 024	R-1
7.23	1	Aux. UHF Rescue Beacon	45-85700-85	Simmonds Aero.: 311016	
7.24	2	Receiver, Command	45-85700-87	Motorola: 201 313 00D	
7.25	1	Matching Network, HF Whip	45-85700-89	Collins: 522 2362 004	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8	1	Environmental Control System, Consisting of:	45-83700	
8.1	1	Valve, Emergency Oxygen, Rate Suit	45-83700-483	132186-1
8.2	1	Valve, Dual Cabin Pressure Control and Repressurization	45-83700-485	102344-2
8.3	1	Valve, Condensate Removal	45-83700-39	PS175210
8.4	1	Regulator, Suit Pressure	45-83700-41	132190
8.5	1	Trap, Solids	45-83700-43	174310
8.6	2	Blower, Internal Circuit	45-83700-49	207970
8.7	4	Valve, Oxygen Check	45-83700-53	123104
8.8	1	Sensor, Blower Pressure Differential	45-83700-421	PS 207272
8.9	1	Absorber, Internal Circuit Water	45-83700-59	175830
8.10	1	Tank, Cooling Water	45-83700-61	175320
8.11	2	Valve, Comfort Control	45-83700-491	121078-1
8.12	1	Controls, Box	45-83700-65	510352
8.13	2	Cap Assy., Water Line	45-83700-69	PS 173162-1
8.14	1	Valve, Cabin Pressure Relief and Emergency Decompression	45-83700-77	102350

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.15	1	Valve, Post Landing Outflow	45-83700-79	122216
8.16	1	Valve, Ground Oxygen Inlet	45-83700-81	PS 137205 (Rev. B)
8.17	1	Blower, Equipment	45-83700-425	207990
8.18		Deleted		
8.19	1	Valve, Suit Pressure Relief	45-83700-87	130100
8.20	1	Orifice, Flow Limiting	45-83700-89	PS 174410
8.21	2	Valve, Freon 114 Check	45-83700-91	PS 132200
8.22	1	Valve, Ground Ventilation Inlet	45-83700-191	122304
8.23	1	Valve, Snorkel Inflow	45-83700-211	121074-1
8.24	1	Valve, Snorkel Outflow	45-83700-101	121048
8.25	1	Switch, Pressure	45-83700-493	133186-1
8.26	1	Valve, Solenoid-Switch	45-83700-105	319190-2
8.27	1	Valve, Pressure Test	45-83700-419	PS 130098-1
8.28	1	Assembly, Normal Oxygen Bottle	45-83700-431	134292-1
8.29		Deleted		
8.30	1	Assembly, Normal Oxygen Pressure Regulator	45-83700-497	132254-1

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CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION AiResearch No.
8.31	1	Assembly, Emergency O_2 Bottle	45-83700-435	134300-1
8.32	1	Valve, Ground Vent Negative Pressure Relief	45-83700-423	130110
8.33	1	Manifold, Suit Inlet	45-83700-175	174253
8.34	1	Duct, Cabin Evaporator Steam	45-83700-177	174363
8.35	1	Manifold, Compressor Outlet	45-83700-179	174479
8.36	1	Fitting, Suit Pressure Regulator Outlet	45-83700-181	174295
8.37	1	Duct, Water Separator Exit	45-83700-183	174364
8.38	1	Manifold, Compressor Inlet	45-83700-187	174366
8.39	1	Bracket, Cabin Pressure Control Valve	45-83700-193	174693
8.40	2	Transducer, O_2 Pressure	45-83700-495	512727
8.41	1	Assembly, Emergency O_2 Pressure Regulator	45-83700-499	132256-1
8.42	1	CO_2 Absorber and Odor Control Internal Circuit	45-83700-417	175950
8.43	1	Manifold, Solids Trap Exit	45-83700-437	174365
8.44	1	Exchanger, Internal Circuit Heat	45-83700-479	174250-2 MRR No. 30AE10

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.45	1	Exchanger, Cabin Equipment Heat	45-83700-481	174260-1
8.46	1	Duct, Ground Vent. Inflow	45-83700-443	175212
8.47	1	Valve, System Shutoff	45-83700-455	122260-1 MRR No. 10JA30

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
9		Instrumentation System, Consisting of:		
9.1	1	Camera, Astronaut Observer, 16 mm	45-88704-1	Milliken: DBM-8A
9.1.1	1	Lens, 10 mm, f1.8		Bell and Howell: "Ingenue"
9.1.2	AS/R	Film, 16 mm, on Aluminum Reels	---*	DuPont: P931A
9.2	1	Camera, Instrumentation Observation, 16 mm	45-88704-3	Milliken: DBM7A
9.2.1	1	Lens, 10 mm, f1.8	---	Bell and Howell: "Ingenue"
9.2.2	AS/R	Film, 16 mm, on Aluminum Reels	---*	DuPont: P931A
9.3	1	Tape Recorder, Including	45-88707-1	Consolidated Electrodynamics (CEC)
9.3.1	1	Speed Change Kit (1-7/8 ips)	45-88707-13	CEC
9.3.2	1	Transport Assembly	45-88707-15	CEC
9.3.3	2	Reel	45-88707-17*	CEC
9.3.4	4800 Ft.	Tape, 1/2 inch	45-88707-19*	Minn. Mining and Mfg.: 197

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
9.4	1	Instrumentation Package "A" Including:	45-88100-75	---
9.4.1	1	D.C. Power Supply, 3V Monitor	45-88203-3	---
9.4.2	1	Resistance Element, A.C. Power	45-88206-1	---
9.4.3	2	Resistance Element Amplifier	45-88207-13	---
9.4.4	1	Resistance Element, Amplifier	45-88207-9	---
9.4.5	1	Resistance Element Amplifier	45-88207-7	---
9.4.6	1	Resistance Element Amplifier	45-88207-11	---
9.4.7	1	Amplifier, Body Temperature	45-88703-7	---
9.4.8	1	Amplifier, Body Temperature	45-88215-9	---
9.4.9	2	PDM/PAM Commutator/ Keyer	45-88709-3	Gen. Devices: 1208D-2B
9.4.10	2	Amplifier, CO_2 Partial Pressure	45-88715-5	Tapco: 04-600370
9.4.11	2	Probe, Temperature, Cabin Air	45-88720-3	Transonics: 1182B

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
9.4.12	1	Transformer, Filament	---	Comm. Accessories: 76-0056-35
9.4.13	2	Capacitor	---	GE: 29F577 (10 μf)
9.4.14	1	Resistor	---	Int. Resistor Co.: GBT-1/2 20K5%
9.5	1	Instrumentation Package "B", Including:	45-88101-61	---
9.5.1	2	Accelerometer, "Y" and "X" Axis, ± 4g	45-88712-5	Donner: 4310-2
9.5.2	1	Accelerometer, "Z" Axis, ± 30g	45-88712-3	Donner: 4310-1
9.5.3	2	Voltage Controlled Oscillator - 1.3 KC	45-88700-13	Dorsett: O-8M1.3KC
9.5.4	2	Voltage Controlled Oscillator - 1.7 KC	45-88700-15	Dorsett: O-8M1.7KC
9.5.5	2	Voltage Controlled Oscillator - 2.3 KC	45-88700-17	Dorsett: O-8M2.3KC
9.5.6	2	Voltage Controlled Oscillator - 10.5 KC	45-88700-27	Dorsett: O-8MA10.5KC
9.5.7	1	Compensating Oscillator	45-88700-53	Dorsett: 20-8M
9.5.8	2	Mixer Amplifier	45-88700-55	Dorsett: ASM-8M
9.5.9	2	Amplifier, Rate Signal	45-88214-7	---
9.5.10	1	Amplifier, Rate Signal	45-88214-9	---

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
9.5.11	1	Noise Level Pick-Up System Including:	45-88713-1	Gulton: KPL-1
9.5.11.1	1	Transducer	45-88713-7	Gulton: R420M-1MAC
9.5.11.2	1	Amplifier	45-88713-9	Gulton: R4400-1MAC
9.5.11.3	1	Cable Assembly	---	Gulton: KPL-101
9.6	1	Instrumentation Package "C", Including:	45-88102-49	---
9.6.1	1	Solenoid Voltage Attenuator	45-88205-1	---
9.6.2	1	Solenoid Voltage Attenuator	45-88205-3	---
9.6.3	1	Amplifier, Horizon Scanner	45-88212-7	---
9.6.4	2	Amplifier, D.C.	45-88703-1	---
9.6.5	2	Amplifier, O_2 Partial Pressure	45-88708-5	Tapco: 04-600380 Mod.
9.6.6	4	EKG Amplifier	45-88702-1	Tapco: 04-600390
9.6.7	1	Transducer, O_2 Partial Pressure	45-88708-3	Neville:
9.6.8	1	Transducer, Cabin Pressure	45-88705-3	CEC: 4-380MU-25A

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

			IDENTIFICATION		
Item	Qty.	Nomenclature	MAC No.	Mfg. No.	
9.6.9	1	Programmer	45-88710-3	Wheaton: M-112-3A	
9.6.10	1	Instrumentation Assembly Rate Signal Filter and Calibrate Card	45-88214-11		
9.7	1	Transducer, Suit Pressure	45-88705-3	CEC: 4-380MU-25A	
9.8	2	Transducer, Suit Inlet Air Temperature	- - - -	Ruge: BN-274	R-1
9.9	2	Transducer, Heat Shield Temperature		Ruge: 6608	
9.10	2	Transducer, Inner Skin Temperature	45-88721-1	Ruge: 3172	
9.11	2	Transducer, Outer Skin Temperature	45-88829	Transonics: 2277	
9.12	2	Transducer, CO_2 Partial Pressure	45-88715-3	Beckman: 71200	
9.13	1	Transducer, Static Pressure	45-88705-5	CEC: 4-380MU-15A	
9.14	1	Analyzer, Vibration and Acoustical	45-88711-1	ASCOP: SA-40	
9.15	1	Vibration Measuring System Consisting of:	45-88714-3	Endevco: 2829	
9.15.1	1	Accelerometer	45-88714-9	Endevco: 2213M5	
9.15.2	1	Amplifier	45-88714-11	Endevco: 2620	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
9.16	1	Instrumentation Assy. - Astronaut Transducer, Consisting of:	45-88822-1	---
9.16.1	1	Body Temperature Probe	45-88814-1	---
9.16.2	1	Connector Patch	---	Goodrich: 2P1051
9.16.3	1	Connector Patch Cover	45-88814-3	---
9.16.4	3	EKG Pick-Up	45-88821-1	---
9.16.5	1	Instrumentation Assy. - Respiration Rate Transducer	45-88801-35	---

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Radioplane No.
10		Landing and Post-Landing System, consisting of:	45-41700-1	R-5100-1
10.1	1	Drogue Chute Assembly, consisting of:	- - - - -	- - - - -
10.1.1	1	Drogue Chute	45-41700-29*	R-5103-309
10.1.2	1	Drogue Bag	45-41700-11*	R-5104
10.1.3	1	Chaff Packet	45-41700-133*	101000-3
10.2	1	Mortar Tube	45-41700-145*	R-5109-309
10.3	1	Mortar Sabot	45-41700-19*	R-5126
10.4	1	Main Chute System, consisting of:	- - - - -	- - - - -
10.4.1	1	Landing Parachute	45-41700-219*	R-5157-321
10.4.2	1	Bag, Main Chute Deployment	45-41700-221*	R-5116-305
10.4.3	1	Lanyard, Antenna	45-41700-181*	R-5135-309
10.4.4	2	Cutter Reef - 4 Second Reefing	45-41700-195*	101092-1
10.4.5	1	Reefing Line	45-41700-199*	R-5157-95
10.4.6	1	Bridle Parachute	45-41700-201*	R-5205-301
10.5	1	Reserve Chute System, consisting of:	- - - - -	- - - - -
10.5.1	1	Landing Parachute	45-41700-219	R-5157-321

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Radioplane No.
10.5.2	1	Pilot Parachute	45-41700-193*	R-5204
10.5.3	1	Bag, Reserve Chute Deployment	45-41700-225	R-5117-309
10.5.4	1	Lanyard, Pilot Chute	45-41700-149*	R-5136-301
10.5.5	1	Reefing Line	45-41700-199*	R-5157-95
10.5.6	2	Cutter Reef - 4 Second Reefing	45-41700-195*	101092-1
10.6	2	Bag, Landing Parachute Ejector	45-41700-37*	R-5118-301
10.7	2	Disconnect, Landing Parachute	45-41700-191	R-5127-301
10.8	1	Projectile Assembly, Pilot Chute Deploy Gun	45-41700-127	101070-23
10.9	1	Shear Pin, Pilot Chute Deploy Gun	45-41700-63	101070-17
10.10	2	Baroswitch, 10,600 Ft.	45-41700-163	101080-15
10.11	1	Switch, Inertia	45-41700-169	58215-305
10.12	1	Packet Assembly, Aluminum Powder Marker	45-41700-119	R-5200
10.13	2	Baroswitch, 42,000 Ft.	45-41700-165	101080-17
10.14	2	Strap Assembly, Ajustable Retaining	45-41700-101	R-5195
10.15	1	Strap Non-adjustable, Insulated	45-41700-117	R-5196

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Radioplane No.
10.16	1	Body Assembly, Gun, Pilot Chute Deploy	45-41700-171	101070-33
10.17	1	Package Assembly, Explosives, consisting of:	45-41700-73*	R-5183
10.17.1	1	Electric Squib, Deployment Gun	45-41700-213*	58082
10.17.2	1	Squib Cartridge, Electric (Drogue Mortar)	45-41700-211*	58081
10.17.3	2	Cartridge, Squib Electric, (Parachute Disconnect)	45-41700-209*	58080
10.17.4	1	Cartridge, Main Charge, Deployment Gun	45-41700-167*	101070-31
10.17.5	1	Gas Generator Assembly	45-41700-215	58217-15
10.17.6	1	Gas Generator Assembly	45-41700-217*	58217-17
10.18	2	Cutter Reefing - 16 Second	45-41700-197*	101092-7
10.19	2	Mounting Bracket	45-41700-205	101092-3
10.20	1	Bag, SOFAR Bomb	45-41700-227	R-5207
10.21	1	Packet Assembly, Shark Repellent	45-41700-203	R-5203

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS*

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
11		Pyrotechnic Devices, Consisting of:	45-72001-18	
11.1	**	Squib, Deployment Gun	45-41700-213	
11.2	**	Squib Cartridge, Drogue Mortar	45-41700-211	
11.3	**	Gas Generator, Main Chute	45-41700-215	
11.4	**	Gas Generator, Reserve Chute	45-41700-217	
11.5	**	Squib Cartridge, Parachute Disconnect	45-41700-209	
11.6	**	Cartridge, Deployment Gun	45-41700-167	
11.7	2	Explosive Bolt, Clamp Ring	45-72702-23	Olin Matheson: 116C-3
11.8	4	Explosive Bolt, Clamp Ring	45-72702-19	Olin Matheson: 112C-7
11.9	1	Explosive Bolt, Retrograde Rocket Ejector	45-72704-9	Olin Matheson: 113C-3
11.10	5	Explosive Disconnect Assembly consisting of:	45-72705-1	Beckman-Whitley: 2243C
11.10.1	11	Explosive Cell	45-72705-5	Beckman-Whitley: 10084
11.10.2	5	Ring Assembly	45-72705-7	Beckman-Whitley:

* Pyrotechnic devices to be shipped to launch site for installation.
** Quantities defined under applicable systems.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS* (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
11.11		Antenna Fairing Ejector	45-72703-17	
11.11.1	2	Cartridge	- - - - -	Olin Matheson: ARD863-1
11.11.2	1	Cartridge	- - - - -	McCormick Selph: 2561
11.11.3	1	Cartridge	- - - - -	Frankford Arsenal: M67E1
11.12	4	Initiator (Chute Disconnect, Capsule and Tower Separation)	- - - - -	Frankford Arsenal: XM-41

* Pyrotechnic devices to be shipped to launch site for installation.
** Quantities defined under applicable systems.

APPENDIX II

DRAWING AND DATA REQUIREMENTS

3.2.1 3.2.2 II.1.0 DRAWING REQUIREMENTS - The contractor shall prepare all working drawings, shop drawings, and detail drawings necessary for the contractor to fabricate and erect all parts of the work and to enable the Contracting Officer to check its conformity with the contract drawings and specifications, or to satisfy the Contracting Officer that all parts can be fabricated or erected as required. The contractor's drawing system for this contract shall be as defined herein.

3.2.2.1 II.1.1 ENGINEERING DRAWINGS - Engineering drawings shall meet the intent of Specification MIL-D-5028B and shall be the production type. The size and format of the drawings shall meet the intent of Standard MIL-STD-2 and MIL-STD-3. The drawings shall be prepared, submitted and approved in accordance with the Contractor's Engineering Manual as modified by EN-220.

II.1.1.1 TYPES - Deleted. (See EN-220)

II.1.1.2 COMPOSITION - Deleted. (See EN-220)

II.1.1.3 CHANGES - Deleted. (See EN-220)

II.1.1.4 APPROVALS - Deleted. (See EN-220)

II.1.1.5 SUBMITTALS - Deleted. (See EN-220)

3.2.2.7 II.1.1.6 VENDOR DRAWINGS - Vendor drawings prepared to contractor specification control drawings shall comply with the requirements set forth herein.

3.2.2.7.1 II.1.1.6.1 COMPOSITION - Vendors shall prepare drawings on their format using their drawing numbers and part numbers when drawings are required to be furnished by such vendors to meet requirements of the Contractor prepared Specification Control Drawing.

3.2.2.7.2 II.1.1.6.2 APPROVALS - The contractor shall submit ten (10) copies of vendor outline installation drawings to the Contracting Officer's Resident Representative for approval after contractor's approval of such drawings. Approval of vendor drawings by the Government shall be as prescribed in MAC Report EN-220. R-1

II.1.1.6.3 SUBMITTALS - Deleted. (See EN-220)

II.2.0 DATA REQUIREMENTS - Deleted. (See EN-220)

APPENDIX II

DRAWING AND DATA REQUIREMENTS

3.3.2.6 1.1.8 II.2.1 GENERAL - The contractor shall furnish, in connection with the work under the contract, copies of planning schedules; significant design studies; drawings, including contractor's identification of symbols and markings (see Paragraph II.1.0); specifications; significant test results and characteristics data, and such other pertinent technical information used in the research, development, design and engineering for the equipment, material or processes specified in the performance of this contract including test equipment and related items.

3.2.2.5.1 3.2.2.5.1.1 3.2.2.5.1.2 3.2.2.5.1.3 3.2.2.5.1.4 II.2.2 REFERENCE DATA - The contractor shall furnish ten (10) copies each of the following:

a. Contractor's Engineering Manual (Volumes 1 and 2).

b. Contractor's EN-220

c. Contractor's Process Specification

d. Contractor's Standard Book

e. Contractor's Design Handbook

3.7 II.2.3 CONTRACTOR-PREPARED SPECIFICATION - The first issue of specification will be submitted on or before sixty (60) days after receipt by the Contractor of an executed copy of the contract. Revised issues of the specification will be submitted on the tenth (10th) day of each sixth (6th) month thereafter and at the time of completion of work under this contract. The final issue of the specification will define for procurement purposes the complete operational capsule system and will describe the quality standards which must be used in the manufacture of the system. R-1

3.3.2 3.3.2.1 3.3.2.2 3.3.2.3 3.3.2.4 3.3.2.5 3.3.2.7 II.2.4 MANUALS AND HANDBOOKS - Manuals and handbooks for the capsule shall be provided by the contractor in accordance with MAC Service Engineering Department Report (SEDR) No. 37 as approved through negotiation with NASA. SEDR No. 37 briefly describes the contents of each manual or handbook, quantity to be furnished, and the delivery schedule.

3.4 3.4.1 3.4.2 3.4.3 3.4.4 3.4.5 3.4.6 II.2.5 BI-MONTHLY STATUS REPORTS - Contractor will submit six (6) copies of bi-monthly letter status reports covering project activity for each calendar bi-monthly period during the project. The first status letter will cover the period from contract date to the end of the second calendar month. Each bi-monthly status letter will present at least the following data:

APPENDIX II

DRAWING AND DATA REQUIREMENTS

II.2.5 BI-MONTHLY STATUS REPORTS - (Continued)

a. Contract number and reporting period.

b. Percentage of completion of total contract effort and of important elements of the project.

c. A concise narrative statement of work accomplished during the period covered by the report. All results either positive or negative will be reported.

d. A statement of critical problems or delays encountered together with causes, corrective action taken or planned and the effect upon project schedules.

e. A brief statement of work scheduled for the following reporting period.

f. Current schedule for remaining project activity.

3.5 II.2.6 MONTHLY FINANCIAL STATUS REPORTS - Contractor will submit six
3.5.1 (6) copies of Monthly Financial Status Reports which will
3.5.2 include the following:
3.5.3
3.5.4 a. Estimated percentage of contract completion.
3.5.5
3.5.6 b. Manhours expended during report period.

c. Cumulative manhours expended to end of report period.

d. Funds expended during report period. (Estimated in lieu of audited accounting records).

e. Total funds expended to accounting audit date nearest to end of report period.

f. Estimated financial commitments (e.g., outstanding purchase orders, etc.)

APPENDIX II

DRAWING AND DATA REQUIREMENTS

3.6 II.2.7 MONTHLY FILM REPORTS - The contractor shall furnish one thousand (1,000) feet of unedited sixteen (16) mm Ektachrome film on a monthly basis together with a camera data sheet and a short written explanation of each scene. All footage will be taken at twenty-four (24) frames per second except for high speed shots.

3.3.1 II.2.8 ADDITIONAL DATA - At any time prior to the expiration of the guarantee period, the Contracting Officer may request, and the contractor shall promptly furnish any additional information, instructions, technical or engineering data, or expert advice necessary for the proper installation, operation and maintenance of the equipment supplied under this specification.

II.2.9 QUALIFICATION STATUS - The contractor shall furnish three (3) copies of all qualification test procedures and results to NASA.

II.2.10 CONTOUR PLOTS OF HF RADIATED PATTERNS- The contractor shall provide nine (9) copies of contour plots of all HF patterns being radiated.

II.2.11 STILL PHOTOGRAPHS - Effective 24 May 1960, the contractor shall provide NASA with six (6) copies of all photographs (both black and white and color) taken in connection with the Mercury Capsule.

II.2.12 RETROGRADE AND POSIGRADE INFORMATION REPORT - The contractor shall furnish fifty (50) copies of a report containing definitions, graphs and tables depicting predictions for all possible conditions of posigrade and retrograde operation, including failure of rockets to fire. The predictions of rocket performance will be based on rocket thrust (velocity measurement) at different capsule weights integrated with respect to sequence of operation (time measurements). This data shall provide information at the world wide range tracking stations so that operators can interpret transmitted capsule data.